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TESTING OF NEW-ZEALAND-GROWN WHEATS.

I. MILLING-QUALITIES.

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IN the growing of wheat, however much maximum-quantity production may be aimed at, it is the quality of the flour produced from the wheat which is of most value to the miller and the baker, and incidentally to the consumer. A good milling-wheat is one which produces the greatest quantity of flour of the best quality. Hence, being of good quality, or "strength" as it is called, such wheat is in greater demand, and consequently should bring a higher price.

Wheats, however, are often valued by their general appearance, weight per bushel, soundness, &c., and bought according to these valuations, not so much attention being paid to their capacity for producing large amounts of flour of good quality. As a matter of fact, good appearance is often associated with "weakness," and weight per bushel is not a sure indication of strength. And although, where these facts are taken into consideration, large yields are often associated with inferior strength, it should be remembered that it has been found possible in many countries to find and develop varieties especially suited to particular districts yet sacrificing little of yield to strength.

STRENGTH IN FLOURS.

It may be advisable at this point to state as exactly as possible what is meant by "strength." Biffen (1) defines it most satisfactorily as follows: "A strong wheat is one which yields flour capable of making large well-piled loaves." Wheat-flour has the property, in common only with rye-flour, of forming when mixed with water a dough which produces, on leavening and baking, a porous bread. This is due to the gluten it contains being able to imprison in small bubbles the gas generated by the fermentative action of yeast. Upon the quantity and quality of this gluten present in the flour its strength largely depends. A strong wheat-flour produces a loaf of larger volume than that produced by a weaker flour.

Flour, as a foodstuff, consists of about 70 per cent. of starch and 10 to 12 per cent. of proteins. These latter are highly complex compounds, for the most part non-crystalline in form. They are assimilated by the body, and furnish that constant supply of energy so necessary to life. Starches are heat-producing substances, while proteins are largely tissue-forming and contribute to the formation of muscle, &c.

One of the oldest methods of determining strength is the separation and weighing of gluten in flour. Gluten is a protein substance, and certain other proteins are associated with it in small amounts. Generally speaking, it may be said that with all grades of flour the higher the percentage of protein the greater the strength to a certain point (3); there is also a very close correlation between the protein in the flour, the quantity and quality of the gluten, and the loaf volume (4, 5). It is well known that there are exceptions to this relationship, but by examining a sufficient number of samples it should be possible to discover and isolate any exceptions to the general rule. Protein content, then, is an important factor in determining strength. Other factors which must be taken into consideration, however, are the volume of water absorbed, the amount of ash present, and the ratio of wet to dry gluten (8).

As regards the amount of gluten present, its quality and other physical properties, many of our locally grown wheats have been found to compare favourably with the strong and medium-strong wheats grown in Australia and North America. In this article, however, it is intended to deal only with the milling-qualities of New Zealand wheats.

CAUSES OF VARIATION IN STRENGTH.

The various influences determining the strength of wheats may be divided into three classes — climate, soil, and variety. It is well-nigh impossible to modify climate; as regards soil-fertility, it may be said that this is rarely a limiting factor in the growing of strong wheats (1, 6); there remains the varietal factor. One has but to turn to the monumental work of W. Farrer in Australia and R. H. Biffen in England to realize the importance of variety. Summed up, it may be said from their work that while the quality of some wheats may change considerably with climate and soil, there are other varieties in cultivation which retain their strength under all conditions. Thus in England the soft wheats grown at the beginning

of the century are being replaced by relatively strong wheats capable of again competing in quality with the imported varieties (2). In Australia the quality of wheats has been advantageously affected by the work of Farrer. It should be possible, then, to adopt in every wheat-growing locality in New Zealand, each with environmental conditions peculiar to itself, some variety which will yield well without at the same time unduly sacrificing quality to quantity. That this is so is apparent from the results tabulated in this and an article which will follow.

The miller has constantly to watch the quality of the flour which he is marketing. His is not the straightforward task of simply milling each wheat as it arrives, but rather must he consider the price which his flour will fetch in relation to the first cost of the wheat and to the cost of manufacture. A flour is judged largely by (*a*) colour, (*b*) strength, and (*c*) weight of flour per bushel of wheat.

No one wheat may satisfy all these requirements; moreover, reliable wheats may vary even from season to season. The miller, therefore, by a system of blending, mixes, say, a strong wheat with one of good colour, and in this way endeavours to maintain a sufficiently high standard wherein the best qualities of each are effectively represented.

EXPERIMENTAL WORK BY THE CHEMISTRY SECTION.

Work has been recently carried out by the Chemistry Section of the Department of Agriculture with the object of ascertaining the milling-yields of varieties of wheats from different localities in New Zealand and the strengths of the resulting flours. Samples were obtained through the various Instructors in Agriculture.

The milling tests have been carried out by means of the Allis Reduction Machine installed in this Laboratory two years ago (see *Journal*, November, 1920, page 249). This is the type of machine used largely in the United States by the different State Agricultural Departments, and also in some of the larger private laboratories. The process as actually carried out on a commercial scale is followed here as closely as possible. Duplicate results to within 0·2 per cent. are obtained; and, though for obvious reasons the actual milling figures may differ slightly from those obtained commercially, it is considered that the ratios of milling tests obtained are strictly comparable. It may be noted in passing that the results obtained in this Laboratory compare closely with those of the experimental mills of both the New South Wales and Queensland Departments of Agriculture (7).

These wheats have been classified as "good" and "very good" only when the amounts of flour obtained on milling have equalled those of a similar classification adopted in New South Wales.

Reviewing the tabulated statement (page 4), it will be seen that four samples of Pearl from various localities are given. The first three may be classified as very good with yields of over 75 per cent., while the remaining sample is a good milling-wheat. The wheats yielding good percentages of flour come from widely separated districts. Although the number of samples of the varieties milled in 1922 was rather small, there is a fair indication that Pearl yields as a rule a large amount of flour.

TABLE I.—MILLING TESTS OF NEW ZEALAND WHEATS (SELECTED RESULTS).

Laboratory Number.	Variety.	Locality and County.	Bran.	Pollard.	Flour.	Remarks on Yield of Flour.
			Per Cent.	Per Cent.	Per Cent.	
P 307	Pearl ..	Weedon's, Paparua ..	9·3	15·5	75·2	Very good.
P 382	,, ..	Frankton, Lake ..	14·4	11·3	74·3	,,
O 811	,, ..	Lincoln, Springs ..	12·3	13·9	73·8	,,
P 306	,, ..	Leeston, Ellesmere ..	11·5	16·1	72·4	Good.
O 812	Velvet (selected)	Lincoln, Springs ..	9·0	15·8	75·2	Very good.
P 294	Velvet ..	Dumbarton, Tuapeka	12·6	13·3	74·1	,,
P 262	,, ..	Windsor Downs, Waimate	11·1	15·8	73·1	,,
P 292	,, ..	Nenthorn (Moonlight), Upper Taieri	12·9	14·2	72·9	Good.
P 291	,, ..	Middlemarch, Upper Taieri	12·2	15·2	72·6	,,
P 290	,, ..	Ditto	12·9	15·3	71·8	,,
P 327	,, ..	Wrey's Bush, Wallace	12·3	16·6	71·6	,,
P 468	,, ..	Winton, Southland ..	15·6	12·9	71·5	,,
O 814	,, ..	Lincoln, Springs ..	13·5	15·7	70·8	,,
P 310	Hunters ..	Killinchy, Ellesmere	14·2	14·0	71·8	,,
P 295	College Hunters	Dumbarton, Tuapeka	13·0	13·4	73·6	Very good.
P 265	,,	Airedale, Waitaki ..	12·8	14·2	73·0	Good.
P 313	,,	Lincoln, Springs ..	14·8	13·5	71·7	,,
P 308	,,	Doyleston, Ellesmere	13·4	15·1	71·5	,,
P 383	Tuscan ..	Malaghan's, Lake ..	13·0	14·4	72·6	,,
P 379	,, ..	Lake	11·4	16·8	71·8	,,
P 381	White Tuscan	,, ...	14·0	13·8	72·2	,,
P 467	,,	Winton, Southland ..	13·7	14·8	71·5	,,
P 315	Solid-straw Tuscan	Annat, Malvern ..	9·5	16·3	74·2	Very good.
P 314	Ditto ..	Domett, Cheviot ..	11·0	15·2	73·8	,,
P 316	,, ..	Hawkins, Selwyn ..	12·2	14·5	73·3	,,
P 325	,, ..	Athol, Wallace ..	10·9	17·2	71·9	Good.
P 319	Purple-straw Tuscan	Greendale, Selwyn ..	14·4	13·7	72·2	,,
P 323	Victor ..	Kirwee, Malvern ..	11·5	12·5	76·0	Excellent.
P 321	,, ..	Horrelville, Eyre ..	12·7	11·8	75·5	Very good.
P 322	,, ..	Domett, Cheviot ..	10·9	14·7	74·4	,,
P 324	,, ..	Irwell, Ellesmere ..	13·4	13·1	73·5	,,
P 263	,, ..	Glenavy, Waimate ..	12·1	16·2	71·7	Good.
		Miscellaneous.				
P 260	Dreadnought	Kurow, Waitaki ..	11·5	13·5	75·0	Very good.
P 259	,,	Kia Ora, Waitaki ..	10·5	16·4	73·1	,,
P 431	Huron ..	Dumbarton, Tuapeka	13·7	11·4	74·9	,,
P 429	Marquis ..	,, ,,	12·4	15·2	72·4	Good.
P 432	Thew ..	,, ,,	14·6	14·3	71·1	,,
O 815	Burbank's Super	Flaxton, Rangiora ..	14·0	16·0	70·0	..

Of the nine samples of Velvet shown, three yielded very good amounts of flour, the one from Lincoln being excellent. The other samples produced good percentages of flour. On the whole the milling-qualities of Velvet are good, ranging from medium to excellent, with a good proportion of good and very good samples. It may be said that for the most part the better flour-yielding Velvet samples

come from the more southern districts. A notable exception to this, however, is the excellent amount of 75·2 per cent. obtained from the selected Velvet variety grown at Lincoln (O 812). A fact worthy of notice is that the commercial sample of the same variety grown in the same locality (O 814) gave 70·8 per cent. of flour.

The sample of Hunters grown at Killinchy yielded a good percentage of flour. College Hunters samples were received from different localities in the South Island. Of the samples milled, as shown in the table, one may be classified as very good, and three as good. The sample from Dumbarton gave the very good yield of 73·6 per cent. of flour, and one from Airedale 73 per cent. These samples, which came from widely distributed districts, do not show any very marked differences in their milling-yields, except that College Hunters grown at Dumbarton and Airedale gave better results than those from the other districts examined in 1922. Of this variety as a whole it may be said that for the year in which these samples were grown it yielded on the average a medium amount of flour.

Three samples only of Tuscan were received, a number too small to give much positive information; of these three, however, two from Lake County produced good percentages of flour — 72·6 and 71·5 respectively. White Tuscan is represented by two samples which gave good yields of flour—72·2 and 71·5 per cent. The first of these was also from the Lakes district; the other was grown at the Winton Experimental Area. Better results were obtained from Solid-straw Tuscan. Of the samples tested, three (from North Canterbury) gave very good yields of flour, and one (from Southland) was classified as good. From these results it may be fair to say that in 1922 Solid-straw Tuscan gave generally a good yield of flour. Purple-straw Tuscan is represented by a sample from Greendale, Selwyn County, testing 72·2 per cent. of flour, which is regarded as a good amount.

The variety Victor gave very interesting results. One sample from Kirwee (P 323) gave the excellent milling-yield of 76 per cent. flour, and three others very good yields—namely, those from Horrelville (75·5 per cent.), Domett (74·4 per cent.), and Irwell (73·5 per cent.). These again (see Solid-straw Tuscan) are all from North Canterbury. A sample from Glenavy, Waimate, gave the fair yield of 71·7 per cent. The average of the five samples is therefore very high, and Victor must be considered, so far as the 1922 figures show, as a variety usually yielding a high percentage of flour. More, however, will be said later regarding the strength of this variety.

There remain six samples which are grouped under the heading "Miscellaneous." Two samples of Dreadnought, both from Waitaki, yielded very good percentages of flour — 75 and 73·1. This is an interesting variety, and it is to be regretted that more samples of it were not received for milling tests. A sample of Huron gave the very good yield of 74·9 per cent. of flour. Marquis was a good wheat with 72·4 per cent. There was then a drop to Thew with 71·1 per cent. These results are interesting, and further reference will be made to them later.

Though the number of samples received in some cases was too small to produce reliable averages, the following figures are given for the totals of some of the varieties tested in 1922 :—

Class.	Variety.	Number of Samples.	Average Percentage of Flour.
Pearl	Pearl	5	73·3
,, ...	Velvet	10	72·4
Hunters	College Hunters	12	71·2
Tuscan	Victor	6	73·7
,, ...	Solid-straw Tuscan ..	7	72·0

SUMMARY AND CONCLUSION.

Summarizing the results, it may be said that in 1922 the Lakes district produced wheats with good milling-qualities, while each of the three samples received from the Upper Taieri was good. The south and middle Canterbury wheats were on the whole very satisfactory in flour-percentage, out of the total number of samples tested two only not being classified as good. Those from north Canterbury reached an equally good standard, more than half of them giving good and very good percentages of flour.

Interesting results were obtained from several varieties not grown to any great extent in New Zealand, and this would suggest that experiments might be tried with these. Provided that their yields per acre were satisfactory, it might be found that they would be specially adapted to certain districts, yielding more satisfactory amounts of flour than some varieties now grown.

On the average the flour-producing quality of New Zealand wheats is shown to be very fair. But, naturally, it will be in the interests of the grower, the miller, the baker, and the consumer if that proportion of the wheats which is yielding not such a good average of flour can be eliminated and in its place the better varieties grown. This should be possible by the adaptation of special wheats to special localities, though what varieties are better adapted than others to this purpose can be determined only by actual experiment. It would appear that the average amount of flour produced by those wheats milling only about 71 per cent. could be increased by some 2 to 3 per cent. or even more. It is needless to point out how much such an increase would affect and improve the all-round value of the Dominion's wheat crop; especially is this so when one considers that an improvement of 2 to 3 per cent. on the gross yield of flour may actually represent an increase of 10 to 15 per cent. in net profits.

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THE CALVING OF DAIRY COWS.

HINTS FOR FARMERS.

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PRELIMINARY MEASURES.

A FORTNIGHT or three weeks before calving-time dairy cows should be removed from fields where turnips or other winter forages of that class are to be had in large quantities, and placed in a clean, fresh grass-paddock with sufficient available shelter. The paddock should be as free as possible from rough conformation, especially swamps, and fences abutting upon steep gullies where there is a danger of calves slipping through. The cow's food should consist only of the grass she gathers, or if there is not enough of this to keep her in fair condition other suitable food should be supplied to cover the deficiency. A few days before calving a good laxative should be given. The animal should be kept dry and warm, but allowed plenty of opportunity for exercise.

Before calving, also, all the hair upon the tail except the brush should be removed with the aid of a pair of horse-clippers. The upper part of the thighs, right up to and around the root of the tail, should be similarly treated, while any long hairs upon the udder should also be removed. These parts should then be well washed with soap and water into which has been put a tablespoonful of disinfectant to a bucketful of water. Most of the standard disinfectants are useful for this purpose; also good sheep-dip preparations at the strength used for dipping.

NORMAL CASES.

When a cow is observed in labour one must not rush to the conclusion that she must be calved at once. Many farmers have so acted and caused much unnecessary pain and often extensive injury to the cow. Before attempting to assist a calver, first wash the hands and arms clean, using some disinfectant, then rub the hands and arms all over with vaseline, soap, or other clean lubricant. Having done this, introduce the hand gently and find out how things are progressing. Should the opening into the womb be too small to admit the hand, do not force matters, but after manipulating the small opening with the forefinger leave the animal for an hour or so. Then try again, using the same precaution as to cleanliness, but never judge when a small opening is found that it will necessarily take hours to sufficiently

open, as relaxation often takes place with extraordinary rapidity. Should there appear, however, to be plenty of room for calving, the water-bag may be broken and an examination made as to the position of the calf. If the two fore feet and the head can be felt well advanced into the external cavity (the normal presentation), given a roomy cow and an average calf, the operator may proceed to calve the patient in the usual way and be successful single-handed. If, however, there is any doubt about being able to calve the animal single-handed, do not touch her until assistance has been secured, as many a good calf and often the cow as well has been lost for want of sufficient assistance at the proper time.

After the calf is clear of the cow the first thing to attend to is clearing away any obstruction that may be adhering to the nose and mouth of the calf. Should it have some difficulty in getting its wind, moving its limbs and vigorously rubbing with a handful of straw will be of much assistance. Having got it to breathe all right, attention should be directed to the navel-cord. Usually this is broken and the bleeding stopped by contraction of the muscular part of the cord when the act of parturition is complete. Sometimes, however, it does not break, and in such case it should be tied with a clean piece of twine about 1 in. from the body, then the remainder cut off close to the cord, but not so close that the twine may slip off. After this is done, or when the navel-cord has broken in the natural course, make the whole of the part germ-proof by a liberal smearing with an antiseptic ointment. This should be carefully attended to, as the navel is the spot where the germs of such diseases as joint-ill gain access, although their results may not show for many days afterwards.

The calf may now be left until the cow has been attended to. The afterbirth need not be troubled about in the meantime unless that part of the cord attached to the cow is bleeding; if so, tie up the bleeding end at once. The cow should be offered a drink of water, with the chill taken off, into which has been stirred a couple of handfuls of oatmeal. Usually she will drink this greedily and be much refreshed. If the animal has come through a hard time a bottle of beer every few hours is one of the best stimulants. The cow should then be made comfortable; it will pay, and the sense of humanity demands that she be given every attention for at least a few days. Milk should be frequently drawn from the cow and a portion of it given to the calf. In no case should a cow be milked dry for a few milkings, but, on the other hand, never allow the udder to be overstocked. Follow the practice that would be adopted by the calf if allowed to suckle its mother. It wants a little at a time and often, and this suits the mother also.

MALPRESENTATIONS AND HOW TO DEAL WITH THEM.

The foregoing is a brief outline of what should be done in normal cases, but unfortunately there are often malpresentations of the calf. Of these there are a great variety, but only the most common will be dealt with here. It should always be borne in mind that one should never attempt to take away a calf until the calf and the cow are got in the most favourable position; to do otherwise is courting disaster. The malpresentation may be by the head and one leg, the head and

three legs (two fore legs and one hind leg or the leg of a twin), legs without the head, no legs and no head, the head alone, or the hind quarters coming first. These are the most common, besides which cases of monstrosities, too big a calf, or a dead calf will occasionally be met with. The procedure here recommended for dealing with some of these abnormal presentations will be of assistance in connection with any other condition not specially referred to.

If the head alone is presented it will have to be pushed far enough back to allow of exploration for the legs. In pushing the head back do not use too much force—just a steady pressure between the expulsion efforts of the cow—and keep the nose well up toward the back so as to be easy of recovery when wanted. Now feel for the fore legs, and when one is secured straighten it out and draw it into the external cavity. Before doing anything further it is advisable to tie a piece of clean cord around the fetlock and let the other end hang outside. In many cases this will be a wise precaution, because this leg may have to be pushed back in order to get at the other, and when found no time is lost in tracing the first one. Once they have been properly straightened out there is no tendency for them to double back. Having got both legs into a favourable position, carefully observe an important rule—*never to pull upon the legs until after the head has been got well forward* into the passage. Here assistance is useful to gently and steadily pull upon the legs while the other operator keeps the head advancing at the same time. If the calf is not coming freely work it a little from side to side, and when it is coming in the correct position never pull straight, but slightly inclined towards the udder. It will also be of advantage sometimes to slightly advance one leg and then the other, as this reduces the width of the shoulders. Meantime, whenever the head appears, keep relieving the skin of the cow from the head and body of the calf. When the head and only one leg is presented push the leg back, as already directed, while the other is being recovered. When more than two legs are coming, great care must be exercised not to put the wrong one back, as even in the case of only two fore legs presented it has sometimes been found that one belongs to one calf and the other to its twin. This is best determined by following up the legs with the hand until the joints are found; these will guide one as to fore or hind legs, and, as a general rule, when three legs are concerned the two foremost are the correct ones.

It is no uncommon occurrence to find only the two fore legs, the head being doubled back along the side of the calf or down towards its brisket. In this case the legs will have to be put back out of the way while one feels for the head. When found, place the forefinger into the side of the calf's mouth; this will give you a good hold to turn the head round, after which a good grip can be got and the lower jaw and the head brought into position. Then recover the legs. Sometimes the calf may be found somewhat upon its back; usually this can be adjusted, but, if not, the pull would in this case be upwards instead of downwards. If the hind quarters are coming first do not attempt to turn the calf, but just take it away in that position, first raising the hind quarters of the cow so that a slightly downward pull will be available. Where the tail only is presented the hind legs will be found doubled up, and it is a somewhat difficult matter to straighten them

out. Personally, I never try to do this until the calf is partly out, as the position they occupy does not offer any resistance to calving, but proceed as follows: Procure a piece of thin, clean, strong rope, such as a plough-line, and pass the end of this through the double of the leg, which would be the hock-joint; bring this end out, and then tie together both ends of the rope used upon the leg. This, when the same operation has been completed upon the other leg, will prevent one from possibly pulling upon the wrong ends, thereby undoing all the work. Now proceed to pull on both legs at the same time until the tips of the hocks appear in sight, then stop. Now introduce the arm and feel for one foot; place this in the hollow of your hand and ask your assistant to pull upon that leg only, still keeping the foot in your hand. The reason for this will soon become apparent, as when the leg is nearly out it will straighten itself with such force that but for your hand that part of the cow would probably be seriously injured. Repeat the same with the other leg, then proceed as already advised.

If by reason of the size of the calf or malformation a difficult case is in prospect the services of a veterinarian should be secured, and that before the cow has been subjected to the usual "Let me have a try" amateur. Should no veterinarian be within reach the only plan is to try the best you can with the aid of some experienced person, and if failure is evident, as is sometimes the case even when a professional man is employed, the cow should be mercifully destroyed.

I cannot recommend the taking-away of the calf in pieces unless an experienced man is employed; neither can I advocate the Cæsarean operation (delivery by cutting walls of abdomen) in the cow, even by professional men, unless in exceptional cases, as the operation and after-attention to the cow would in most cases be more expensive to the owner than the value of both cow and calf. When, however, the failure to calve is due to the size of the calf, and the chances are that both may be lost, the owner must decide which to try to save—first having made sure that the calf is still alive. If it is decided to destroy the cow the whole thing must be done expeditiously and finished before the heart of the cow ceases beating, otherwise the calf will die. This being so, everything required for the operation must be handy. The cow should first be placed under the influence of an anæsthetic. Then turn the animal quickly upon its back and make a long incision along the centre of the belly, extract the calf, and cut the navel-cord about 1 in. from the calf's body, after which slaughter the cow. If the case is an emergency one, and no anæsthetic available, the cow should be stunned, but not bled until after the operation is completed.

REMOVING A DEAD CALF.

When there is a lack of freshness in any discharge coming from the womb, and especially if such discharge is showing a certain amount of decomposition, the indications are that the calf is dead. It may be here mentioned that a cow may calve a live calf and still carry a dead one for some time after. In all cases where the calf is dead the following procedure should be followed before any attempt is made to remove it: Obtain a bucketful of warm water, into this dissolve a few ounces of soap, add a teaspoonful of disinfectant, then inject the whole of the

solution into the womb—the idea being to replace the water which has most likely escaped some days previously, leaving the calf dry. The injection acts as a disinfectant and greatly facilitates the expulsion of the calf. Before proceeding to remove a dead fœtus heavily smear the hands and arms with soap, butter, or other material as a protection against poisoning and an aid to eliminate the very persistent and disagreeable smell from these after the operation is complete. Should the abdomen of the calf be much swollen, open it with a hook-pointed knife, thus relieving the accumulated gases. In some cases, especially those of monstrosities, the limbs may have to be broken or the bones of the head crushed, but in no case should the skin be broken, else there is a likelihood of the cow being scratched internally, which under the circumstances would most likely lead to blood-poisoning.

THE CLEANSING.

All cleansing or afterbirth should be looked for and destroyed, whether healthy or not. However repulsive it may appear, it is a fact that a cow with an abnormal appetite will eat her own or another cow's cleansing and thereby endanger her own health. Cleansings, although they may be previously healthy, are rapidly attacked by disease-producing germs when exposed to the air. It cannot be too strongly impressed upon the stockowner that cleansings left undestroyed not only encourage stray dogs to come about the place, but are a grave danger to the general health of stock. It is not recommended that afterbirth should be removed immediately the calf is born, as it is beneficial to give the cow a chance to do this without much help, but it is strongly recommended that every cow should be washed out immediately after calving, whether she has cleansed or not. The reason for this is that the lower part of the womb is below the external opening even when the cow is lying down, the result being that although all the solid parts of the cleansings may have come away there is always left a small quantity of fluid material. This may rapidly decompose, especially during hot weather, and blood-poisoning result. No disinfectant need be used at this stage, only a bucketful of water which has been boiled and allowed to cool to blood-heat and into which has been dissolved about 2 oz. of soap.

When the cleansing is retained longer than, say, twelve hours it should be removed. Proceed to do this with the same precautions as those advised before calving. First wash the womb out, but now using a little disinfectant in the water. Then with the left hand pull gently upon the exposed portion of the membrane—a good hold can be secured by rolling it around a piece of stick—and with the right hand assist in freeing the membrane from the walls of the womb, without, however, using much force. Should one come across a small patch and be undecided as to what it is, the best course is to leave it alone, but washing-out should be continued every day until all discharge has ceased. If the smell is offensive use more disinfectant.

GENERAL AFTER-CALVING PRECAUTIONS.

The most successful period for the prevention of disease or for combating disease already established in the womb is within the first twenty-four hours after calving. After this contraction rapidly takes place, and the womb cannot again be effectively washed out until

another calving. To demonstrate this the writer some years ago carried out a number of experiments, using forced and gravitation injections of water containing colouring-matter, upon cows about to be slaughtered, after which the womb was carefully examined and the results noted. These confirmed the opinion just expressed, and clearly showed that the contraction of the womb does not effectually expel all foreign matter, but encloses it in such a manner as to prevent any washing-out proces reaching it. Therefore every newly calved cow should be washed out soon after calving, as directed. It can do no harm and will save the life of many animals. At the same time note that all stains of calving should also be cleansed off the cow, as these are favourable breeding-grounds for disease, which in time is liable to attack the healthy organs.

In conclusion, if the farmer wishes his cows to have a healthy recovery and every chance to again produce he should act on the principle that cleanliness comes first, both in regard to the cow and all appliances used.

POPLAR AND ELAEAGNUS WINDBREAK.

[*Photo by T. W. Brown.*

In several articles on shelter-belts and hedges that have appeared in the *Journal* mention has been made of the excellent windbreak formed by a combination of the Lombardy poplar and elæagnus. A good example of this combination, at the Central Development Farm, Weraroa, is shown in the accompanying photograph. There are two rows of poplars, the rows 5 ft. apart, with trees 2 ft. 6 in. apart in the rows. The elæagnus, planted at the same time as the poplars, is in the centre of the space between the two rows of poplars, the plants being 3 ft. apart. The poplars have been topped, but the elæagnus has not at any time been trimmed.

THE RELATION OF BIRDS TO AGRICULTURE IN NEW ZEALAND.

III. THE LARGER FRUIT- AND INSECT-EATING PERCHING-BIRDS (*PASSERES*).

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THE first article of this series discussed briefly the general principles of economic ornithology, while the second dealt with the relation of the forest-birds to the problems of forestry in New Zealand. In this, the third article, it is proposed to commence a more detailed examination of the New Zealand birds from an economic standpoint, to discuss the pros and cons of each species, and, having decided which are beneficial and which injurious, to point out in a simple way how to distinguish friends from foes.

This is the more necessary since, although most country-dwellers have a fair knowledge of the commoner birds, the nests and eggs are much confused. Some agricultural associations, acclimatization societies, and local bodies make a practice of paying for "small birds'" eggs—a practice in which serious lack of discrimination is exercised with regard to the accepted eggs. Thus school-children are actually encouraged to take the eggs of beneficial indigenous birds in their haphazard birds-nesting, in mistake for those of injurious introduced species. We know, for example, of no society which discriminates between the eggs of the native pipit or ground-lark and the imported skylark, yet the former is wholly useful and the latter almost entirely destructive.

There exists, also, at the present time in New Zealand no book of any kind which deals with indigenous and introduced birds alike and affords means of distinguishing them. In the following pages the present state of our knowledge on all these matters will be summarized, but there must be years more of the most patient field observation before the material is available out of which a comprehensive manual can be built.

THE NATIVE CROWS, HUIA, NATIVE THRUSHES, AND SADDLEBACK.

The birds will be dealt with in order of affinity, and at the head of the list are placed the two New Zealand crows or kokakos—North and South Island species respectively. In a work of this kind these, on account of their great decrease under the influences of settlement and their present resultant scarcity, need not detain us long. Their large size and soft bluish-grey plumage relieved by the striking wattles —blue in the North Island bird and orange in the South—render them quite unmistakable; nor is their rich organ-like note, once heard, likely to be confused with that of any other denizen of the New Zealand bush. It is needless to state that their influence in the forest, as agents in the dispersal of the seeds of trees, is wholly beneficent.

Still less to be dealt with in a work treating of the present position in New Zealand are the huia and the two thrushes—North and South Island respectively. While it is uncertain that any of these are totally extinct, from an economic viewpoint they are of such extreme rarity that they are mentioned here only for the sake of completeness. The work of the huia was described in the second article. That of the thrushes, which, by the way, should never be confused with the introduced English song-thrush now so common, was comprised under the two heads of "insect-eating" and "seed-dispersing."

The sixth bird on the list, the saddleback, on account of its exceeding rarity may be dismissed in the same way. Suffice it to state that just as the introduced starling leaves no stone unturned in its indefatigable search for insects of all kinds in cultivated and pastoral country, so this handsome indigenous starling subjected every crevice and cranny of tree and log to the same searching scrutiny.

From the records of the past, and from what we know of the birds which still remain plentiful denizens of the forest, it is a safe assumption that all of these six species performed definite tasks in the economy of the forest which it would be fatuous to suppose can be as well accomplished either by the other remaining indigenous species or by the introduced birds, which are adapted only to the environment to which they were accustomed in their original northern home.

THE STITCH-BIRD, TUI, AND BELL-BIRD.

In the next natural group, which comprises the honey-eaters, there are four birds—the stitch-bird, tui, bell-bird, and white-eye.

The stitch-bird, though once very common, is now—like most of the group already mentioned—of extreme rarity, and is economically negligible. It was at one time doubtless one of the most important of the forest-flower pollinators in the North Island (to which it is confined). Like all members of this group, though primarily a honey-eater, it feeds largely upon forest berries and insects as well.

The tui (or parson-bird), by far the largest and most conspicuous of the New Zealand honey-eaters, is almost too well known to need description, but something must be said of its nest and eggs. The nest is wide (9 in. to 1 ft. across) but shallow, and generally has rather an untidy look owing to its being made of interlaced fine twigs the ends of which project in all directions beyond the general outline of the nest. Manuka twigs seem to be the most often chosen when they are available. The shallow cavity is generally lined with the dark scales from young tree-fern fronds. The eggs—three or four in number—are very fragile-looking, and white or pale pink in colour, with a few scattered pinkish-brown spots mostly at the larger end. They range from 1 in. to 1½ in. long by ¾ in. or more broad.

The value of the tui as a fruit and honey eater in relation to the forest has been spoken of in the previous article. No one familiar with the bird or its habits in the bush will deny this, but what may be again emphasized here is the work it does in pollinating the many species of *Eucalyptus* that are now being planted everywhere for timber, and thus assisting their spread.

It appears that the persecution of the tui is not confined to the bush itself, but that even those which venture to visit the gum plantations in settled areas are in some districts shot for gastronomic

purposes by Maoris. The decay of *tapu* and the spread of firearms have, generally speaking, turned the Maori into a serious enemy of all the forest-birds which are large enough for food.

The bell-bird, makomako, or "mocker" (an often-used corruption of the Maori name), is one of those native birds which, after showing a great decline in numbers, are now more than holding their own. The bell-bird, however, is much less familiar to most people than the tui, partly owing to its quite recent return to settled districts, and largely no doubt to its smaller size and less conspicuous colour. It is not much over 7 in. in total length (the tui being 1 ft. or more long), while its olive-green steely black and brown colour is very difficult to see compared with the glittering blues and greens of the tui's dark plumage and the white neck-tuft which shows so strongly against it. The nest of the bell-bird, like the tui's, is largely constructed of small twigs and moss, but is much smaller and neater, and is lined with feathers. The eggs are similar to those of the tui in texture, but are rather richer in ground-colour and in markings. They are nearly 1 in. long by almost $\frac{3}{4}$ in. broad. What has been said of the good work done by the tui in the bush applies almost equally well to that of the bell-bird, while in many *Eucalyptus*-planted districts the latter is the commoner bird of the two.

It should be mentioned here that there is often confusion as the result of the practice prevalent in many districts of calling the crow or kokako "bell-bird," and reserving for the true bell-bird the name of makomako, "mocker," or even that final corruption "mocking-bird."

THE WHITE-EYE (WAX-EYE, SILVER-EYE, RING-EYE, OR BLIGHT-BIRD) (*Zosterops lateralis* Latham).

The multiplicity of names bestowed on this little bird is sufficient evidence of its familiarity. Under one or other of these titles its olive-green head and tail, grey back, and pale under-parts tinged very beautifully with reddish, and, above all, the ring of white feathers round the eye, are probably well known to most people. Its numerous relatives are found over a large part of the eastern world and particularly in Australia, where our own white-eye also belongs, since its colonization of New Zealand was apparently accomplished within the memory of man. It first appeared in this country, in the neighbourhood of Wellington, in 1856, and from that centre has apparently spread almost all over both Islands. In the first spring of its arrival, according to Buller, the *tauhou*, or "stranger," as the Maoris called the feathered immigrant, was accorded a warm welcome on account of its energetic attack on the woolly aphis—then, as now, a difficult pest of apple-trees. Later on its attentions to cherries, plums, and other fruits led orchardists and the Press to revise their first impressions and to restrain the enthusiasm of their eulogy.

For the greater part of the year the white-eye consorts in twittering parties or flocks which work assiduously from tree to tree in their search for insects of all kinds. Like the birds which have been artificially introduced or "acclimatized," to use the expression of those who practise it, the white-eye seeks the wilder solitudes far less than do those birds which are peculiar to New Zealand. It frequents gardens, orchards, and the vicinity of cultivation generally. In winter the small parties are considerably augmented, and large flocks then

repair to the gardens of even the most populous towns. Even in summer small travelling-parties may occasionally be seen in the most thickly populated districts.

There are several birds, both native and introduced, similar to the white-eye in size, but the nest of the latter (Fig. 1) cannot be confused with that of any other bird in New Zealand. It is a basket-shaped structure, attached by the rim at several places to two or more twigs lying more or less in the same horizontal plane. Though it may rest against twigs lying below it, the nest is never dependent on them for its support, and may be therefore truly described as pendulous or hanging. It is very frail-looking, often showing the light through it, but owing to the skilful interweaving of the grasses, mosses, &c., of which it is built it is really a very strong structure. It is generally

FIG. 1. NEST OF WHITE-EYE, SHOWING HOW IT IS SUSPENDED.

[*Photo by G. H. Cunningham.*

lined with grass, with the wiry leaves of the grass-tree (*Dracophyllum* spp.), and very often, particularly near settled areas, with horse-hair. The eggs, of which three or four are laid in the nest, average under $\frac{3}{4}$ in. in length. Their beautiful pale-blue colour combined with their small size distinguishes them from all other eggs found in New Zealand, except possibly those of the hedge-sparrow, which are larger and far deeper blue in colour.

The activities of the white-eye may be discussed under the following headings: (1) Pollination of flowers of trees, (2) dispersal of weed-seeds and tree-seeds, (3) damage to fruit, and (4) destruction of insects. From the economic standpoint (1) and (4) can be adjudged as wholly beneficial, (3) as wholly destructive, and (2) as a mixture of good and evil, between which a fair balance must be struck in considering the treatment the white-eye should receive from the cultivator.

The first of these activities has been dealt with generally in the second article of this series, in which the general importance of pollination by birds in the New Zealand forest was strongly emphasized. It is necessary only to point out here that while in the untouched forest itself the greater part of the work will probably still be carried out by the tui and the bell-bird, to which the native timber-trees had become more intimately adapted before the white-eye came to New Zealand, still in settled districts where these birds are less common the ubiquitous white-eye will doubtless perform good service. Even in the city it is a common sight in winter or late autumn to see white-eyes busily engaged on the flowers of the brush-wattle (*Albizzia lophantha*). In the bush itself the flowers of the various ratas (*Metrosideros* spp.) are visited for their honey, while their relative, the ornamental pohutukawa of our gardens and sea-coasts, receives the same attentions. So much for the white-eye's work in the pollination of trees and shrubs. This is a subject on which further and fuller observation is greatly needed, and it is one which can be studied by observation alone. In other parts of this investigation it is conceivable that the examination of birds' stomachs might be of some service; in this part it would obviously be useless.

In May last almost every patch of inkweed-plants (*Phytolacca octandra*) in the Auckland District was the centre of an animated scene owing to the parties of white-eyes which were feeding with avidity on the berries. In early portions of the district the bright-red bare spikes gave striking evidence of the quantity of fruit already eaten. Inkweed is dependent on birds for its spread; the hard black seeds could not easily be carried by any other method. It must not be supposed, however, that the white-eye is the sole exploiter of the juicy black fruit, for such introduced birds as starlings and thrushes certainly account for large quantities, while pheasants are said also to feed upon the berries. The blackberry—perhaps the most serious weed in New Zealand—is also, so far as the seed is concerned, spread solely by birds; but while there is little doubt that the white-eye will eat blackberries there seems no evidence to convict it of the major share in disseminating this pest. The blame for that must rather be laid at the door of certain of the introduced birds which are so overwhelmingly abundant in settled districts. The berries of another weed, the black nightshade (*Solanum nigrum*), are also eagerly eaten by the white-eye.

In the bush itself probably none of the smaller berries are disdained. It is here that the white-eye must be considered as an ally of the forester; so far as its forest activities are concerned, it does nothing but good.

It is when we come to the work of the white-eye in the orchard during the fruit season that there is need for all the good qualities of the species to vindicate it in the opinion of the fruit industry. There is scarcely any fruit which is not eaten, and some, such as figs, are hardly attacked at all by other birds. It is questionable, however, whether the greatest damage to fruit of all kinds is not the work of the blackbird, myna, starling, and thrush, which by reason of their great concentration of numbers in settled districts, and larger size, account for a greater quantity. There are indications that apples and pears are rarely attacked by white-eyes until the skin has first been pierced

by the stouter bills of these larger birds. The white-eye acts, as it were, as a jackal to the myna, blackbird, and starling, picking clean the cores left by them hanging or shaken to the ground. At such times, when engaged near the ground or on a scrap-heap or in a fowlyard pecking at a bone, the white-eye falls a frequent and easy victim to the household cat. An apple which has been "finished" by a white-eye is always to be recognized by the frequent survival of large portions, or even almost all of the skin, surrounding the clean-picked core, but between them an empty space.

When the white-eye turns its attention to stone-fruits it commits other damage than the destruction of fruit alone. Mr. G. H. Cunningham in a recent bulletin (No. 101, "Brown-rot") of this Department states, "Mr. J. C. Neill informs me that at Weraroa a small bird, locally known as 'silver-eye' (*Zosterops lateralis* Latham), is the cause of widespread brown-rot infection. With their beaks the birds commonly pierce infected fruits, and turn from these to healthy fruits, especially those showing colour, such as nectarines, which in turn they puncture, probably with a view of ascertaining whether they are edible."

In discussing the work of the white-eye in destroying those multifarious insect species which are summed up in the words "insect blights" it is difficult to overestimate its value to all who cultivate the land. Buller wrote, "I have opened many specimens, at all seasons, and I have invariably found their stomachs crammed with minute insects and their larvæ." The cabbage or turnip aphis, which sometimes infests crops of swedes, turnips, or allied plants to an incredible extent, is frequently cleared by this winged insecticide. In accordance with the principle that birds concentrate on the most abundantly available food, the presence of such a severe infestation as just described, when almost every leaf over acres is blue with aphides, is the stimulus which brings hundreds of white-eyes to the district where previously they perhaps have been but little in evidence. Here they remain until, from their viewpoint, the unexpected food-supply is exhausted, and, from our standpoint, until the pest is eradicated.

Whenever a set of advantageous conditions has so far favoured an insect pest that at last it breaks all bounds, as in the case of the cabbage-aphis referred to, or whenever a pest is introduced by natural or artificial means into a district where large quantities of its food plant have been hitherto uninfested, as in the case of the blue-gum scale (*Eriococcus coriaceus*), there the birds will be concentrated, as vultures follow the battle. In a large number of these cases the birds which concentrate on the pest are the white-eyes. With regard to the last case mentioned, that of the gum-tree scale, it must be admitted that the infestation in a new plantation is usually so overwhelming that the white-eyes are far too few to be of much service in clearing the trees. They are, however, one of the factors tending to right the balance of nature.

Another eucalypt insect eaten with avidity by the white-eye is the blue-gum psyllid (*Rhinocola eucalypti*) which infests the growing tips of young gums throughout the country.

The person, however, who must bear the whole cost of the white-eye's unfortunate proclivity for fruit is the orchardist, and it is not to be expected that he will be so altruistic as to maintain a corps of winged operators which will work solely in the interests of the farmer and the forester. Fortunately, it happens that it is in the orchard itself—the scene of its crimes—that the good points of the white-eye are displayed to the best advantage. A. H. Chisholm, writing in an Australian magazine on the relation of this bird to the orchardist, states that in Victoria it eagerly devours aphides of all species, codlin-moth, and pear-slug. A Hastings (Hawke's Bay) orchardist has described to us how he has repeatedly watched white-eyes eating woolly aphis. It is no exaggeration to say that nearly every major insect pest of the New Zealand orchard is in one stage or another of its existence searched out and eaten by the parties of white-eyes which subject every tree, every twig, and every crevice to the strictest surveillance. There can be no question that the value of the services rendered by the white-eye in the orchard alone in destroying insect pests throughout the year more than counterbalance the depredations committed during the ripe-fruit season.

It has been said that the value of insect-eating birds, of which the white-eye is one of our most conspicuous examples, is seriously lessened by the fact that they do not discriminate between the many beneficial insects which prey upon or parasitize our pests and the injurious insects themselves. F. E. L. Beale (1908) in the United States has answered this objection by showing that if birds are really indiscriminate in their taste the result will be a reduction of beneficial and injurious species by the same amount, thus leaving exactly the same proportion of useful species to attack the injurious species and maintaining the balance unaltered.

DODDER IN NEW-ZEALAND-GROWN CLOVERS.

PRECAUTIONS TO BE OBSERVED.

NELSON R. FOY, Biological Laboratory, Wellington.

ACCORDING to reports received from Great Britain and the United States, considerable trouble has been experienced through the occurrence of dodder-seed (*Cuscuta* spp.) in New Zealand white clover and cow-grass exported during 1922–23.

Previous to last year little had been heard of dodder in our clovers, and it was popularly supposed that the white clover and cow-grass rarely if ever contained this impurity. Whether it is that there is more of the dodder-plant growing in the clover crops, or that the bringing into operation of the new British Seed Act has made it more difficult for affected seed to gain entry unnoticed, is not easy to say. The writer is inclined to think that the sudden prominence gained by the dodder question is due in part to both of the suggestions put forward. The most unfortunate feature is that in many cases discovery of

the dodder does not take place until the seed reaches its destination, and then naturally the overseas buyers are not anxious to take delivery, as under the British Seed Act it is unlawful to sell clover containing dodder. Arbitration follows, and in many cases the seed has been returned to the shippers in New Zealand.

It is only fair to state that the New Zealand merchant does not knowingly ship such seed, but does so under the impression that it is "dodder free," such impression being gained from the analyses issued from the seed-testing branch of this Laboratory. Further, it is also fair to state that these analyses-reports issued are a true and correct statement of the purity of the *sample forwarded*. From this it might appear that the trouble is beyond remedy, but such is not the case.

When present, dodder is always in small quantities—from one seed in an ounce to one in a pound. Further, in New Zealand dodder grows only in small isolated patches, and it follows, therefore, that the seed will not be distributed evenly throughout the line. For example, the first two sacks examined may not contain it, and the third will. It will thus be seen that it is very possible to draw a sample—or, indeed, several samples—free from dodder, and then draw a further one which does contain dodder. In an actual instance three samples were drawn from a line of white clover—the first prior to shipment, and the other two (from bulk sample retained in New Zealand) after the line had been held up in Great Britain on account of dodder content. The first and second samples were dodder-free, but the third contained two seeds of dodder to the ounce. Each sample was approximately 1 oz. in weight. Such occurrences mean bad business for the merchant, and are tending to cause English seed firms to avoid New Zealand clovers—in both cases a decidedly unsatisfactory state of affairs.

The remedy—or at least nine-tenths of it—is in the hands of the New Zealand merchant and the grower; the other tenth must be left to chance. Particularly thorough sampling of export lines is absolutely essential. To obtain a thoroughly well-mixed sample one should be drawn from top, middle, and bottom of each sack of the line. This is especially necessary in the case of dodder, for, as already mentioned, the weed may occur only in quite small patches in the field, and only quite a few of the sacks may contain the impurity. The drawn seed should then be mixed, and as large a composite sample as is convenient drawn from it.

The foregoing may seem a somewhat laborious process, but it is the only way in which a thoroughly representative sample may be obtained, and a representative sample is essential if the analysis is to show the true state of the line as regards purity. Farmers themselves can also materially assist in maintaining the reputation of New Zealand clover by carefully examining their fields before harvesting, in order to ascertain whether any dodder is present.

Agricultural Exports.—The value of the agricultural products exported from New Zealand during the year ended 31st March, 1923, was £42,248,751, or 93 per cent. of the total exports in that period.

DAIRY-HERD IMPROVEMENT.*

SOME LEADING FACTORS.

W. M. SINGLETON, Director of the Dairy Division.

HERD-TESTING.

"By their fruits ye shall know them" is a saying not more true of human beings than of dairy cattle, and there is conclusive evidence that during the past two seasons our dairy-farmers have been more inclined to obtain an accurate idea of what amount of butterfat the individual dairy cow is delivering. Until more recent years comparatively little testing was done—partly because many dairymen were making a comfortable living without going to that trouble, and partly because many thought the Babcock machine could not tell them very much about their cows; in other cases, again, the releaser system of machine milking did not facilitate the taking of individual samples and milk-weights. In some instances it is possible that owners were rather afraid that some of their favourite cows might not make good, and as a consequence did not test. However, more dairymen are now facing facts, and in the past season some eighty-four thousand cows were tested for yield under the association system.

The influence of herd-testing is frequently very manifest during the second testing season for the herd. For example, among the herd-testing associations whose computations were made at the headquarters of the Dairy Division during 1920–21 and 1921–22 were some 218 herds which were tested in both these seasons. The yield of the average cow in these herds increased from 213 lb. to 253 lb. of butterfat, or about 19 per cent. Even granting that some portion of this increase may have been due to the fact that 1921–22 was a better season for grass, much of the improvement is undoubtedly due to knowledge gained as the result of the previous season's testing. In these herds the number of cows tested each season was very similar. Our figures show that often dairy-farmers reduce their herds as the result of testing, and still maintain the total yield of the herd. We also have data which show that in certain cases during a second testing season with only two-thirds of the previous season's herd the total butterfat produced underwent no reduction, while one dairy-farmer during his first testing-year milked twenty-three cows to produce as much butterfat as did sixteen which he milked two seasons later. Instances which bear out the same principle could be multiplied. The first testing season's returns were prejudiced by overstocking and therefore underfeeding.

MANAGEMENT.

Like children, dairy cows are perhaps more often "sinned against than sinning." The yield of the average dairy cow in New Zealand

* Substance of a paper read at the annual conference of the New Zealand Council of Agriculture, Wellington, July, 1923.

would be very materially increased with better feeding and attention, for there are many cows in our herds which if given all the feed they can consume and convert into milk would produce much larger credits for butterfat. Not all crossbred cows would respond as well as purebred, but our experience in testing purebreds goes to indicate that frequently it is the owner and not the cow who is the cause of poor production. One breeder in the early days of the certificate-of-record system entered over thirty purebred cows for test in one season. With so large a team it was found impossible to give the individual attention requisite for the production of good records, and the result was that only two of the cows produced as high as 400 lb. of butterfat—the season's work, so far as C.O.R. testing was concerned, being undoubtedly a failure. However, a number of the cows were retested during a later season and under better conditions, with the result that the butterfat records were increased as follows: Lot 1: First record, 351 lb.; second record, 581 lb. Lot 2: First record, 319 lb.; second record, 528 lb. Lot 3: First record, 304 lb.; second record, 566 lb. Lot 4: First record, 286 lb.; second record, 630 lb.

THE CULL-COW PROBLEM.

It is necessary that known low producers which have been culled should as far as possible be prevented from entering other dairy herds if the greatest improvement in the production of our average cow is to be safeguarded. Many methods of solving the cull-cow problem have been put forward, but so far no really successful way out of the difficulty has been found. Branding has frequently been urged, but is, or would be, difficult to enforce; and spaying has been practised by some with satisfactory results. The best solution in the end, however, may be found to be better breeding, which will lessen the proportion of low producers as results become more generally extended throughout our dairy herds.

INFLUENCE OF THE PUREBRED SIRE.

The influence of the purebred sire has been often stressed, and not without reason. In a herd of registered purebred dairy cattle it may be assumed that a purebred sire is at least "one-half the herd." This will, of course, depend on the breeding. In many purebred herds, and also in grade or crossbred dairy herds, a registered purebred sire of good breeding is more than half the herd. It is more prepotent for good or evil, as the case may be. The Dairy Division possesses tabulated records of ninety dairy cows and of daughters of these cows sired by purebred dairy bulls. The records were made at various ages, but correcting them to a basis of records at mature age it has been found that the records of the daughters are 28 per cent. higher than those of the dams. Possibly some of the daughters had better testing-conditions than their dams, as the owners may have profited by experience obtained while the dams were under test or after they were tested; but even if the percentage of improvement is reduced from 28 to, say, 10 there still remains a potent recommendation for better breeding.

It is becoming more generally recognized that the earning-power of purebred stock is considerably above that of scrub stock, even if

sales of progeny be eliminated from consideration. That this principle holds good with dairy stock in an exceptional degree will, I believe, be admitted. The fact is becoming evidenced in the increase in the proportion of purebred dairy bulls in use in dairy herds. During the 1917–18 season some 8·5 per cent. of the total bulls in such use were purebred Jersey, Friesian, Ayrshire, or Guernsey. During the 1921–22 season the percentage was 14·5, and a marked increase may be expected during the next decade. This extension of better breeding practice is one of the most encouraging factors among those affecting herd-improvement, largely because it is possibly the most potent factor operating in that direction. Given a reasonably good environment, including suitable feed, high-grade or purebred cows may be relied upon to produce from 25 to 50 per cent. more than scrubs. In one of our best herd-testing associations the lowest-yielding herd was headed by a grade Shorthorn sire, whereas all herds averaging 300 lb. of butterfat or over were headed by purebred dairy sires.

BREEDING METHODS.

The most popular system of breeding, and one which can be strongly recommended, is that known as line-breeding. This may be indicated as mating a grandson to granddaughters or great-granddaughters of the same animal by a different line. This class of breeding fixes type more slowly than inbreeding, but by means of the bringing-in of the outcrosses it enables the correction of defects in the strain whose blood lines are being concentrated. Line-breeding is a safe system, and does not require the consummate skill which inbreeding demands of the breeder so far as selection and culling are concerned. Inbreeding, which implies the mating of such near relatives as sire and daughter, son and mother, or brother and sister, accentuates inferior factors just as readily as good ones, and may be responsible for sterility, lack of constitution, or defective type, if such exist in the animal whose blood lines are being concentrated in the progeny. The Duchess family of Shorthorns developed sterility because the original Duchess was a "shy breeder."

HEREDITY AND ENVIRONMENT.

There has for years been a difference of opinion between scientists regarding the extent of the respective influence of heredity and environment. But so far as these affect the evolution of a good dairy herd there should be no difficulty. The best breeders believe in endowing the calf at conception with all the factors pertaining to heavy production which heredity can give it through good breeding. This, however, must be followed by suitable environment, such as will enable that calf, both before and after birth, to so develop that those hereditary factors may not be handicapped in any way, but may get free play to carry out that for which they were preordained by Nature. Thus heifer dairy calves in the hands of the best owners will not only be well bred, but grown on foods which will promote excellent growth, constitution, and capacity. If the young animal be underfed and small the heredity factors for high production cannot possibly produce the large yields of which they would be capable if housed in a well-developed body maintained by a strong constitution.

NEW ZEALAND AND DENMARK.

Denmark began cow-testing much earlier than New Zealand; in fact, I believe that some Danish dairymen were weighing the milk of individual cows before Wellington was founded in 1840. The first cow-testing associations in Denmark were started in 1895, and in 1921–22 there were tested through milk-recording societies some 230,000 out of a total of 1,184,000 dairy cows, some 20 per cent. thus being under test.

In the past 1922–23 season New Zealand has tested some 84,000 out of a total of 1,137,000, or about 7·35 per cent. We have a considerable distance to go yet along this line, but judging by the two last seasons' progress we are catching up very well indeed. The butterfat yield of the average Danish cow on test for the 1921 season was 261 lb. The yield in New Zealand for the 1921–22 season was some 245 lb. for cows on association test. This difference between the Danish and New Zealand average cow on test is not so large but that we may hope to overtake it, but personally I do not consider the overtaking of it a vital matter in the meantime. I consider it better to overtake the proportion of cows being tested, even although this might bring under test animals which would lower the average yield of cows on test.

We estimated the butterfat yield of the average cow in New Zealand during the 1921–22 season, taking those in milk and dry, as 168 lb. If one animal in ten be non-productive this gives the yield of the average cow in milk as 187 lb. The average butterfat yield of 660,000 cows supplying Danish co-operative creameries during 1920–21 was 198 lb., as nearly as can be calculated. It should therefore not be impossible for us to overtake the Danes. In the meantime dairying in New Zealand is in the evolutionary stage. In a young country such as this, where the dairy industry is extending each year, we cannot expect to attain to the production of the average cow of, say, Denmark until our cow population stabilizes in greater degree. The Dominion's carrying-capacity for dairy cows is increasing rapidly. New land is being steadily brought into grass, and top-dressing is improving older pastures. Our dairy-cow population has increased by over 50 per cent. in the last five years, the 1923 statistics showing another gain of 100,000 head.

When the dairy land in this country is all brought in as in Denmark, and when the number of our dairy cows shows little or no increase, we may reasonably expect greater improvement in their average yield. We can then cull the herds more severely, and the influence of better breeding and culling will be more generally demonstrated. I believe it to be only a matter of time until the New Zealand dairyman has the best-yielding average dairy cow in the world.

Importation of Sheep into Argentina. — Under a recently issued Argentine decree sheep for breeding purposes may be imported into Argentina from New Zealand and Australia even if they have been transhipped at Cape Town, provided that their sanitary condition is satisfactory and that they arrive with the regulation certificates.

WALNUT-BLIGHT.

INTRODUCTION OF IMMUNE VARIETY BY THE DEPARTMENT.

Horticulture Division.

THE ravages of the bacterial disease of walnuts (*Pseudomonas juglandis*) has rendered walnut-growing very precarious—so much so, indeed, that the Department does not think it wise while the present conditions obtain to encourage the extensive planting of the tree for the production of nuts. The present condition of the noted walnut-groves at Akaroa is well known. A few years ago these groves were a good source of income to their owners. During the past few years the blight has attacked the trees, and their production has dwindled to an almost negligible quantity.

This blight is not confined to New Zealand; it is a serious pest wherever walnuts are grown. Owing to its bacterial nature spraying is useless, and no other way of controlling it on affected trees has yet been discovered. The hope for the future appears to be in working the desired varieties on stocks immune to the bacterial disease. It has long been known that in California the native black-walnut (*Juglans Hindsii*) is used for the purpose. This species is a very strong grower, makes a very handsome tree, and is the favourite avenue tree in California. It is immune to the bacterial disease, and has been proved to be suitable as a stock. The nuts it bears are similar to other walnuts, but are smaller. They have exceedingly thick shells and only a small amount of meat.

Six years ago the Department sent an order to California for a bushel of these nuts, but in spite of repeated inquiries the nuts were not received till March of last year. On receipt of the nuts arrangements were made with the Nurserymen's Association for the nuts to be distributed to leading nurserymen, they agreeing to raise the trees and to use them for working commercial varieties. Under this arrangement a considerable number of trees should be available for purchase in the spring of 1924 or 1925.

The former practice was to raise trees from nuts. The resultant trees would bear fruit when from nine to twelve years old, except in cases where the trees, being in unsuitable soil, became stunted. They might then bear earlier, but would never make thrifty trees. Budded trees usually begin to bear nuts at the third year; in fact, nuts were frequently produced by young trees in the nursery rows. It will be seen that it pays to wait even a few years for budded trees.

During the currency of the Panama-Pacific Exposition, at San Francisco, in 1915, Mr. E. Clifton, the New Zealand Commissioner, sent us a small parcel of *Juglans Hindsii* nuts. Trees raised from these nuts are now growing at Te Kauwhata Horticultural Station, and in a few years' time should be a source from which nuts can be obtained for raising stocks.

EARLY SPRAYING FOR APPLE AND PEAR BLACK-SPOT.

THE STAGES OF BLOSSOM-DEVELOPMENT.

N. J. ADAMSON, Orchard Instructor, Thames.

SOME confusion seems to exist among fruitgrowers, particularly amateurs and those not long engaged in the industry, on account of the multiplicity of terms used to describe the various stages of apple or pear blossom-bud development, with a resultant doubt as to the correct strength of spray to apply at a particular stage. The accompanying drawings show the various distinct stages, and may be described as in the second column of the following spray schedule :—

Key Number of Drawing.	Stage of Development.	Lime-sulphur-spray Formula.	Bordeaux-spray Formula.
1	Green-tip	1–10	5–4–50
2	Tight-cluster	..	
3	Open-cluster	1–25	3–4–50
4	Pink	1–35	
5	Full-bloom	..	..
6	Petal-fall	1–100 to	..
7	Calyx-closed	1 120	

Bordeaux at the pink stage is liable to cause russeting, and its use then is advised only on varieties very susceptible to the disease and in unfavourable positions. If bordeaux is used at this stage an earlier bordeaux spraying could possibly be dispensed with. Due regard must be given to tenderness of variety and its liability to russeting. On less susceptible varieties and more tender ones usually two sprayings are advisable—one at the green-tip to open-cluster stage (either bordeaux, 5–4–50, or lime-sulphur, 1–10 to 1–25, according to stage of bud-development), and one at the pink stage (lime-sulphur, 1–35). Subsequent sprayings on all varieties would be lime-sulphur. Probably some slight adjustment in these spraying-strengths would be necessary to meet local requirements.

On account of some irregularity in the development of the blossom-buds it is necessary to take notice not of the most advanced, but of the majority in determining when to spray. For instance, at the pink stage some of the more advanced buds, principally those on the terminals, would be fully open, and at open-cluster a proportion of buds would be pink.

STAGES OF APPLE-BLOSSOM DEVELOPMENT.

(1) Green-tip; (2) tight-cluster; (3) open-cluster; (4) pink; (5) full-bloom; (6) petal-fall; (7) calyx-closed.

[*Drawing by N. J. Adamson.*

EXPORTATION OF EGGS.

POINTS FOR GUIDANCE OF PRODUCERS.

F. C. BROWN, Chief Poultry Instructor.

WITH the object of testing outside markets in order to relieve the local market when the latter is oversupplied, and to ascertain the best means of shipping eggs abroad, the New Zealand Poultry Association proposes to make a trial shipment of eggs to London in the coming spring. The shipment is to comprise 2,000 cases of fresh eggs of 30 dozen each, and a quantity of egg-pulp. It is anticipated that the returns will be payable, while the fact that large numbers of eggs are to be sent out of the country will undoubtedly have a strengthening effect on the local markets. Eggs produced in the winter months invariably give profitable returns, but it is the output of the more favourable periods for egg-production, which often has to be sold at a poor margin of profit, that it is intended to relieve. The export of a due proportion of these eggs is therefore most desirable, providing always that they have fair prospect of a payable market abroad.

In reckoning the prices likely to be secured for eggs on the London market, as a guide for comparing these with local values, sufficient consideration may perhaps not be given to the special quality of eggs required for the oversea trade. Thus, in considering the proposed trial shipment sufficient stress will probably not be laid on the fact that the eggs must be of undoubted quality, to say nothing of the risks by way of breakages in transit, &c. In this country top prices may often be obtained for eggs of poor quality, but on the London market it is entirely different. To compete successfully on that market not only must the eggs be fresh and spotlessly clean and inviting, but they must be uniform in size—namely, 2 oz. in weight—while eggs of different colours must be kept separate. The bloom, the colour of the yolk, and the size of the air-cell (this being an indication of age) must also be taken into account. Further, the eggs must be carefully graded, and packed in the best possible condition and style.

Such eggs would no doubt realize special payable prices at any period of the year on the local market, having regard to the fact that in too many cases the market rate is fixed just on eggs, quite irrespective of their size and age. Here the question arises, has the local market been fully exploited with eggs of the right quality? Be this as it may, the fact remains that the great bulk of producers at the present time in this country have yet to learn that great essential of marketing their eggs to the best advantage. Unfortunately, poultry-keeping at present suffers more through the weak system of marketing adopted than perhaps any other rural industry.

If the trial export shipment of eggs is to be a success it is imperative that distinct improved methods be adopted as compared with the manner in which the local trade is generally catered for. Failing

this, the producer cannot expect anything but second- and third-grade prices on the critical London market. Eggs, as in the case of any other exportable commodity, practically always involve a loss when they are marketed in poor condition.

POINTS FOR SPECIAL ATTENTION.

The points to which special attention should be given by producers in their endeavour to establish an export trade are as follows :—

Size.—Eggs to be not less than 2 oz. in weight, nor more than 2 oz. 2 dr.

Freshness.—Eggs to be strictly fresh. To ensure freshness they should be collected at least daily, or, better still, twice daily. Especially is the latter advisable when any hens are broody. On no account forward eggs for export which have been found in stolen nests outside. They may be fit for home consumption but not for export.

Where to keep.—Keep the eggs, after collecting, in a cool, dry place that is free from objectionable odours. Eggs are very susceptible to taint when kept in a room with vegetables, &c., and every care should be taken to prevent this.

Regular Marketing.—Eggs should be sent to the collecting-depot twice weekly, and oftener if circumstances permit. Remember that an egg commences to deteriorate from the day it is laid. A new-laid egg is full, the air-cell being scarcely perceptible. With age the air-cell increases in size. All eggs with the air-cell dried down to more than $\frac{3}{16}$ in. in depth will be rejected for export. Producers should never hold over eggs, as in doing so the eggs are apt to seriously depreciate in value and be rejected as stale eggs.

Cleanliness.—This means clean dry nests. For the nests use clean dry hay, straw, or other suitable material; renew the material frequently, and always whenever it becomes wet or soiled.

No Washing.—Eggs for export should not be washed, as it reduces their keeping-quality. It also removes the desirable natural bloom, giving the eggs an old stale appearance. Egg-washing can be reduced to a minimum by keeping the birds under cover when the runs are wet, and by keeping the nests clean and sanitary, together with frequently collecting the eggs. Any dirt on an egg when it is collected should be at once removed by means of a dry cloth. If this method fails, a slightly damped but not wet cloth may be used. A good appearance suggests high-class quality, which is an essential in securing best returns and establishing a profitable connection on a market. A good article should look a good article. It is important that no egg be exported with even a spot of dirt on it.

Infertility.—Only non-fertilized eggs should be packed for export, as a fertile egg will commence to develop and deteriorate much sooner than a sterile egg. This involves the removal of all males from the females. The male bird is not necessary for the production of eggs; more and better eggs will be produced without him.

Shell-quality.—The quality of the shell has a considerable influence on the keeping-quality of an egg. A thick-shelled egg is most desirable

for an export trade, because it is less liable to infection than one with a thin shell, and because a thin shell is much more easily broken. Breakages are not only a direct loss, but indirectly cause loss on other eggs that get soiled with the contents of the broken egg. It should always be remembered that the loss through breakages will have to be borne by the eggs that survive during handling in transit. Further, as the size of the air-cell is usually regarded as the chief guide to the age of an egg, and as thin shells favour the rapid drying-down of this cell, it will be seen that such eggs much sooner become a doubtful article than is the case with thick-shelled eggs. Losses through thin-shelled eggs can be considerably reduced by keeping the birds well supplied with fresh crushed oyster-shell or burnt bone, and testing out all eggs with thin shells before forwarding to the collecting-depot. As a shell-forming material fresh oyster-shell is most desirable. Bleached shell, such as is often collected from the seashore, is not so good, as it neither produces the desired strength of egg-shell nor the desired bloom upon it.

Shape and Uniformity. — Eggs are produced in many different shapes. Long and narrow eggs should never be packed for export, nor should deformed and overlarge eggs, as they are not only liable to be broken in transit, but they also spoil uniformity of the line. Home markets can only be secured with eggs of high standard quality and which are uniform in all respects.

Yolk and White.—The condition of the yolk is an important matter. The yolks most desired are those of a reddish-yellow colour, not pure yellow. A pale sickly-coloured yolk is objectionable and unsuitable for export, whether it be eggs in the shell or egg-pulp. Good colour and flavour are largely influenced by the food supplied to the birds. This should consist of sound grain, plenty of green material, and untainted meat in moderation. The inclusion of yellow maize and lucerne or clovers in the ration will tend to produce rich-coloured yolks. Generally speaking, root crops, such as mangolds, &c., if fed to excess, will produce pale yolks and thin whites. The white should be firm and thick. The older the egg the thinner the white becomes. With a fresh egg, when being tested before a light, the egg-content will remain firm. Conversely, the contents of an egg with a thin white will be found to move when the slightest movement of the hand is made. Such eggs are next to useless for export.

Mustiness. — Mustiness probably causes more annoyance when using chilled eggs than all other things put together, for one musty egg broken into a mixture will spoil the whole. Producers are urged to seriously guard against musty eggs being packed for export. A stale egg can be detected by the candle process of testing, but a musty egg may pass the keenest of operators. Indeed, only the person with a keen sense of smell can distinguish a musty egg when broken. The most common cause of mustiness is dampness; therefore eggs should always be kept dry, which means dry nests. Contact with wet material or exposure to moisture or rain causes eggs to go musty quickly. It is of special importance when eggs are being taken to market that they should be protected from wet by a suitable rainproof covering. The common practice of allowing cases of eggs to stand uncovered on a railway-platform or in an open cart during rain is merely inviting

mustiness and making the eggs next to useless for export. Mustiness may also be caused by feeding damaged foodstuffs, such as mouldy maize, wheat, &c., while mouldy bread will have a similar effect.

"*Grass Eggs.*"—These are eggs showing a greenish discoloration. The overfeeding of rape is a common cause of this trouble in hen-eggs, while in the case of duck-eggs the feeding of acorns will bring about a similar undesirable condition. Grass eggs are absolutely unsuitable for export.

Packing.—Many cases of eggs are likely to arrive at the collecting-depots in a broken condition owing to improper packing, although a little care and attention on the part of the producer would prevent this. Never pack in rough-and-ready boxes with straw chaff, or breakages will be the result. Eggs packed in chaff are unsuitable for export in shell; besides they are useless for pulping purposes. The only safe course is to pack the eggs in wire carriers or in cardboard fillings which are made for the purpose. To ensure perfect condition it is necessary to pack the cases so that the contents cannot shift, no matter in what position the package is placed. Wood-wool pads, one placed on top, bottom, and centre of the case, will ensure this where cardboard fillings are used, while the case should be packed in such a way that there is a slight bulge in the centre of the lid. The lid should be nailed at each end, and the middle left free to create a springy condition. It is important that the crates be properly addressed, and the word "Eggs" stamped well over the box in order that the railway-men, carters, and others may see at a glance what the case contains.

GENERAL.

What applies in the case of eggs in the shell intended for export applies with equal force to eggs intended for egg-pulp. The same great care should also be exercised with all eggs intended for consumption on the local market. Whether for the oversea or the local market, it should be the aim of all producers to establish a reputation and then maintain that reputation. This can be achieved only by placing in the hands of the consumers guaranteed eggs in the best possible condition and style.

If the impending trial shipment of eggs is to prove a success the producer must in the first place send to the collecting-depots only eggs that are fresh in the strictest sense of the word, and clean and properly graded. It then lies with the depot-managers to carefully test, examine, and repack the eggs in standard cases so that they may be in the best possible condition for official grading. The next step is to place them on board ship as soon after grading as possible. Given these conditions, the rest lies with the experts in refrigeration.

Election of Board of Agriculture.—At a recent meeting of the Board of Agriculture a letter was received from the agricultural and pastoral societies in the Nelson, Marlborough, and Westland Districts suggesting that the regulations relating to the election of members of the Board be amended so as to permit of the election being conducted by post. It was decided to recommend the matter to the Government for favourable consideration.

APPLE FLESH-COLLAPSE OR BROWN-HEART.

CONTROL MEASURES FOR ORCHARD AND COOL STORE.

R. WATERS, Biological Laboratory, Wellington.

INTRODUCTION.

THE demand for the best-known means of controlling apple flesh-collapse requires at once that a definite stand shall be taken as to the cause of the disease. While, however, sufficient evidence is forthcoming to justify such a stand being taken for practical purposes, our knowledge of this subject must still be regarded as incomplete. The following authorities may briefly be quoted :—

(1.) Mr. A. H. Ashbolt, the present Agent-General for Tasmania in London, and Sir Henry Jones, experimenting at Hobart some years ago, propounded the theory that brown-heart was due to suffocation. (2.) The Department of Scientific and Industrial Research, in London and at Cambridge, reporting upon the damaged cargoes of Australian apples in 1922, stated that they thought they were "safe in concluding quite definitely that the cause of the damage to these shipments is lack of oxygen combined with a high percentage of carbon dioxide in the holds; in other words, the apples are suffocated." (3.) Dr. Charles Brooks, Pathologist to the United States Department of Agriculture, is reported as saying that he thinks the disease is largely due to the accumulation of gases given off by the apples. (4.) Professor McAlpine, Australian Commonwealth Investigator of Fruit-disease, says brown-heart is caused by lack of oxygen and excess of carbon dioxide. (5.) Drs. Ballard, Magness, and Hawkins, of the United States Department of Agriculture, say that internal browning (as they term this disease) appears to be brought about by certain conditions within the fruit itself. (6.) We in New Zealand have shown that no organism is to be found that would account for the disease, and, further, that apples submerged in water or confined in an airtight vessel eventually sustain an internal injury indistinguishable from flesh-collapse. In these experiments, moreover, it was noteworthy that in the absence of oxygen a greater or lesser portion of the flesh of the apple (Sturmers) was injured but not browned. Only after subsequent exposure to the air did such injured tissues discolour in a manner characteristic of flesh-collapse.

From the foregoing there appears a considerable concurrence of opinion as to the main cause of flesh-collapse. Despite this, however, it must not be forgotten that when a case of apples is subjected to a deficiency of oxygen and an excess of carbon dioxide all the apples in that case do not become uniformly injured by flesh-collapse as a rule. This suggests that there are differences in the susceptibility of individual apples, and this suggestion is borne out by the maturity experiments conducted by the New Zealand Department of Agriculture. In these experiments the riper Sturmers suffered more from flesh-collapse than did the greener ones. Apart, therefore, from the suffocation of the apples through a deficiency of oxygen, we must recognize

a difference in the ability of apples to cope with these circumstances. Furthermore, the matter of temperature would appear to have a bearing. Drs. Ballard, Magness, and Hawkins state definitely that internal browning develops to a far greater extent in fruit held at 32° F. than in that kept at 36° to 40°, and its occurrence to an extent sufficient to be important commercially can be largely prevented by storing the Pajaro Valley apples (Yellow Newtons) at 36° to 38°.

For practical purposes the factors contributing to flesh-collapse, so far as we know them, may be summarized as follows :—

(1.) Apples supplied with an insufficiency of oxygen in a short time are liable to suffer internal injury, not necessarily marked at once by the discoloration characteristic of flesh-collapse.

(2.) In "airtight" apple-stores such insufficiency of oxgyen is accompanied by an excess of carbon dioxide, for the apples convert the former into the latter in the process of respiration.

(3.) Subsequently, in the presence of a sufficiency of oxygen, the tissues where previously injured commence to discolour, producing the browned symptom characteristic of flesh-collapse.

(4.) Varieties, lines, and even individual apples in the same case vary considerably in their susceptibility to flesh-collapse, some exhibiting immunity under conditions that are most productive of the disease. One of the main causes, if not the main cause, of this susceptibility is overmaturity for the conditions with which the fruit has to contend in cool storage. There is, however, every reason for believing that certain improvements in cool-storage conditions will enable the fruit to be stored at a more advanced stage of maturity than would otherwise be possible.

(5.) Temperature has also been suggested as having a bearing upon the prevalence of flesh-collapse.

With this outlook it is now proposed to approach the question of apple-preservation from the orchard through the cool store to the market, referring, as the subject is proceeded with, to any knowledge that may be applied at any stage as a preventive of flesh-collapse.

ORCHARD CONDITIONS.

In a report made in November, 1920, I stated that the field conditions rendered satisfactory cool storage not impossible but more difficult than in certain past years. Locality, weather, cultivation, manurial treatment, age of trees, maturity of fruit, method of packing for storage, cases, and time elapsing between picking and delivery to cool store, all doubtless have to some extent a bearing upon the final power of the apple to stand up to the cool-storage conditions that are available to the orchardist at present.

Locality.

Ballard, Magness, and Hawkins state that internal browning is most prone to occur in Yellow Newtons from the floor of the lower Pajaro Valley, where conditions of low temperature and high humidity during the growing season are coupled with very fertile soil ; but that even in this valley there are certain seasons in which little browning

develops, and in seasons when it does develop there are certain trees the fruits of which show little browning, and even from those trees most of the fruit of which show bad browning certain apples will remain entirely sound in cool storage.

It can be said definitely that certain apples of the same variety and size, picked on the same days and by the same pickers from the same trees, and stored within twenty-four hours, have kept well in one cool store, while in another they have developed flesh-collapse abundantly. Moreover, the valley country that in 1921 we deemed in New Zealand to produce the most resistant fruit gave a considerable amount of flesh-collapse in 1922. Our evidence does not confirm the view of Ballard, Magness, and Hawkins; on the contrary, my report made in 1922 recorded that "the matter of locality would appear to be relatively insignificant concerning the cause of this disease." On the other hand, we have shown that overmaturity does contribute to the amount of damage from flesh-collapse. The results secured by these three investigators might therefore possibly be explained by the variation in the degree of maturity in the fruit under observation. I would certainly hold that, so far as New Zealand is concerned, locality in itself is a minor matter in connection with the development of flesh-collapse in cool stores.

Weather, Cultivation, Fertilizers, and Age of Trees.

While weather conditions may have some slight bearing upon the occurrence of flesh-collapse, there is actually no evidence to show that the nature of the weather ever made it appreciably more difficult to store the fruit. In fact, in seasons when the weather conditions were suspected we find fruit from the same trees keeping well in one cool store but developing flesh-collapse in another.

Cultivation is also held to play but a minor part. It would certainly help to neutralize any extreme weather conditions, but as a factor inducing or preventing flesh-collapse little more importance than this is ascribed to it.

Ballard, Magness, and Hawkins state as a result of their experiments with fertilizers: "In general it may be said that the results have been negative so far as causing or preventing browning through fertilizers is concerned."

It is often held that the fruit from young trees is more liable to flesh-collapse than that from older trees. New Zealand experiments show definitely that Sturmers from seven- and eight-year-old trees are capable of perfectly satisfactory cool storage. It is inconceivable that the abundance of flesh-collapse we have met with in the past three years developed because the injured fruit came from trees of less than eight years old.

Maturity.

Experiments instituted early in 1922 demonstrate clearly that apples cool-stored at different stages of maturity show marked differences in their susceptibility to flesh-collapse. There is no doubt that this aspect of the question has not received the attention it deserves. The Australasian Refrigerated Tonnage Committee drew attention to this fact in September, 1922. Certain investigators have published

their conclusions regarding this disease without mention of the maturity of the fruit under experiment. Certainly there are some difficulties in determining experimentally whether the development of flesh-collapse can be attributed to any extent to overmaturity. The first of these difficulties is to determine what constitutes any special stage of maturity, and the second is to select for experimentation a number of apples coinciding in respect to their stage of maturity. No precision can be ensured in this matter. The fact is that the judgment as to maturity is made mainly on appearance of colour, and that the seasonal conditions, the nature of the locality, the amount of the leafage of the trees, and other factors are liable to modify these appearances upon which maturity is judged.

The lack of precision in this matter is a real difficulty in the way of securing consistent results in experimentation; it has no doubt been responsible for several irregularities in the results of my maturity experiments last year. Despite this difficulty, it was absolutely necessary that some attempt should be made to determine the influence of maturity upon flesh-collapse, so vital is this question both to the apple-grower and the cool-store interest. The position of these two parties is as follows: The apple-grower, on the one hand, expects to pay for cool storage out of the increase in profits from selling out of season when prices are high; his aim is to unload when the prices are at their highest. Cool storage, on the other hand, has won a place for itself because it has made this possible. When, however, the fruit is at last marketed one line competes with another. The highest prices go for lines with those qualities that appeal to the customer. One of these qualities is colour, and colour increases with maturity, and the more advanced the maturity the more difficult is it to store the fruit successfully. The accompanying table gives some details of experiments showing the effects of maturity upon the development of flesh-collapse in cool store:—

TABLE I.—SHOWING THE AVERAGE PERCENTAGE OF STURMER APPLES AFFECTED BY FLESH-COLLAPSE IN COOL STORE, AMONG THE OVERMATURE, THE MATURE, AND THE LESS-MATURE FRUIT RESPECTIVELY, AT EACH EXAMINATION.

Date picked and stored.	Date examined.	Duration of Cool Storage.	Extent to which Overmature affected.				Extent to which Mature affected.				Extent to which Less Mature affected.			
			Very Bad.	Bad.	Slight	Total	Very Bad.	Bad.	Slight	Total	Very Bad.	Bad.	Slight	Total.
1922.	1922.	Mths.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Ber Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
29 April ..	29 Aug.	4·0	5	16	39	**60**	..	..	..	..	..	..	..	..
11 ,, ..	29 ,,	4·5	..	..	..	..	0	1	10	**11**	..	..	..	..
30 March	29 ,,	5·0	..	..	..	..	..	..	..	..	0	1	8	**9**
29 April ..	4 Oct.	5·0	3	13	52	**68**	..	..	..	..	..	..	..	..
11 ,, ..	4 ,,	5·5	..	..	..	..	0	2	19	**21**	..	..	..	..
30 March	4 ,,	6·0	..	..	..	..	..	..	..	..	0	1	9	**10**
29 April ..	3 Nov.	6·0	9	16	53	**78**	..	..	..	..	..	..	..	..
11 ,, ..	3 ,,	6·5	..	..	..	..	3	7	26	**36**	..	..	..	..
30 March	3 ,,	7·0	..	..	..	..	..	..	..	..	1	3	9	**13**

It will be seen that Sturmers were used in these experiments, and that an attempt was made to select three distinct stages of maturity, these being called "overmature," "mature," and "less mature"

respectively. All the fruit was practically of the same size—namely, $2\frac{3}{4}$ in. diameter—and was cool-stored within twenty-four hours of picking. The less-mature apples were picked and stored on 30th March, the mature apples on 11th April, and the overmature on 29th April. The overmature apples had thus been exposed to cool-storage conditions a month less than the less-mature fruit at the dates when they were examined. Despite this, it will be seen that they suffered most from flesh-collapse. The experiment was conducted in triplicate, three separate cool rooms being used (unfortunately, the overmature fruit was omitted in the third room). Moreover, in each cool room the experiment was duplicated. In recording the results fifty apples from each line were cut and examined for the presence of flesh-collapse only. Three such examinations were made at intervals of one month—firstly, on 29th August, when the fruit had been cool-stored for four to five months; secondly, on 4th October, after five or six months' storage; and, thirdly, on 3rd November, after six to seven months' storage.

One consistent feature of the experiment was the fact that the overmature fruit invariably showed a greater percentage of flesh-collapse than the mature or the less-mature fruit. In most cases there was twice as much of the disease found in the overmature fruit, the extent of the injury ranging from 38 up to 92 per cent. This is the most noteworthy feature of these experiments, indicating as it does that even under cool-storage conditions that favour the development of the disease much loss—probably 50 per cent. in some cases—can be averted by the selection of less-mature fruit for storage. Now, the reduction in the amount of flesh-collapse by picking the fruit in a greener state may be of immediate value in arresting the serious losses that some growers have sustained for two or three years past, but I fully recognize that alteration of the stage of maturity to suit the cool-storage conditions is not a desirable move if it is going to reduce the ultimate attractiveness and market value of the fruit. The selection of greener fruit is to be regarded as a temporary precautionary measure. There is no doubt whatever that cool storage will shortly be modified so as to enable the more attractive lines to be stored satisfactorily.

The stage of maturity, therefore, has a very direct bearing upon the percentage of flesh-collapse developed in cool storage, but better cool-storage conditions will enable the more mature lines to be stored satisfactorily. In the meantime the judgment of the condition required for storage presents no little difficulty to the grower. One who has suffered badly from flesh-collapse must select less-mature fruit, but not so green as to give rise to premature shrivelling.

Packing.

So far as packing for the cool store is concerned, there are several points that may be availed of as temporary precautionary measures. Anything that facilitates the escape of gases from the case into the chamber is of assistance. This will be better appreciated when the cool-storage conditions are considered. Close packing and the use of paper or wood-wool may be considered an advantage, or may even be essential in certain circumstances, but for the prevention of flesh-

collapse in uncertain cool-storage conditions they are to be avoided. For similar reasons liberal spaces between the boards of the cases are helpful.

Time elapsing between Picking and Delivery.

There appear to be several factors that may influence the results from delayed storage. If delayed delivery results in marked over-maturity, then one would expect a consequent increase in flesh-collapse under cool-storage conditions. On the other hand, the first four weeks are the most difficult in which to secure satisfactory conditions in the cool store, and delayed delivery may result in better storage conditions outside than would be obtained in the cool store, with a consequent increase in the longevity of the fruit. Under such circumstances I would view delayed storage as a good temporary measure, but would certainly say that the ultimate aim should be to bring the cool-store conditions at the commencement of the storage season to such a state of perfection that they shall be at least as good as any conditions obtainable outside.

COOL-STORE CONDITIONS.

The present circumstances call for definite working arrangements for the prevention of flesh-collapse, and I therefore here set out a definite plan—not expecting that it should necessarily be adopted in its entirety, but that it may form a basis for discussion for those with wide experience in the storage of apples.

Temperature-range.

I would suggest a slight alteration in the method of judging the temperature of apple cool stores. My proposal is that the discharge thermometer commonly used should be hung between the discharge-duct and the stack, midway between the ceiling and the floor, its purpose to be mainly to enable the engineer to avoid exceeding the minimum discharge temperature during the hours of running. In addition to this I suggest that a second thermometer be tightly sunk into a medium-sized apple in a case in, say, the third row from the discharge end, on a level with the discharge thermometer; its purpose would be to indicate the apple-flesh temperature at the discharge end, and enable the engineer to avoid exceeding the minimum apple-flesh temperature. A third thermometer is also suggested, to be situated at the suction end, and sunk tightly into an apple in a case midway between the floor and the ceiling, its purpose being to enable the engineer to avoid exceeding the maximum apple-flesh temperature. In large stores other thermometers may be required at various places in pairs, one in the air and the other sunk in apple-flesh; these will enable the circulation to be diverted as required by incoming fruit.

Another suggestion is that the minimum discharge temperature shall be 31° F., the minimum apple-flesh temperature at the discharge end 32°, and the maximum apple-flesh temperature at the suction end 36°. It will be seen that this system admits of fluctuation in the temperature of the chamber-atmosphere, provided that such fluctuation does not cause the apple-flesh to exceed its minimum and maximum temperatures. The use of an automatic recording thermometer at the discharge end is also strongly recommended.

The next point that requires special attention is the actual manipulation of the plant at the beginning of the storage season, in a manner that these temperatures may be secured, this being the time when flesh-collapse is most likely to be set up. The excellent work of the Department of Scientific and Industrial Research, of Cambridge, has afforded us definite information as to the effects of high temperatures at the commencement of cool storage. It shows that at 50° apples packed in an airtight hold are liable to be damaged by flesh-collapse after two or three days. Now, our apples will arrive at the cool store with a flesh-temperature between 50° and 60°, and the first problem is to reduce that temperature, for the lower the temperature of the apple-flesh the slower does it consume oxygen, and the less likelihood, then, is there of suffocation and flesh-collapse. If adequate ventilation could be provided apples could remain in a mean temperature of 50° for months (as is done when they are stored in an ordinary shed), or they might be exposed to a temperature of as low as 20° for several hours, without subsequently developing flesh-collapse. With this proviso, it is therefore not essential that the initial apple-flesh temperatures of 50° to 60° shall be reduced to 32° in two or three days, but it is nevertheless highly desirable to do so, for, as the temperature comes down, the risk of a deficiency of oxygen becomes less and less.

I would further suggest that cool rooms should be thoroughly cooled before the admission of the fruit, and the flesh-temperature of the apples reduced to about 40° by the end of the first twenty-four hours, and to 32° by the end of the next twenty-four hours. Where fruit is being received into a large cool room over a long period special attention will be required at those parts of the room where warm fruit has been stacked previously. At first, owing to there being very little fruit in a large store, or, later, owing to the addition of large quantities of warm fruit on the same day, or to the actual time occupied in the receipt and stacking of fruit, it may be difficult with some plants to secure the required drop in apple-flesh temperature in the required time without exceeding the minimum discharge temperature. When, for instance, fruit is being received it may not be possible to work the full twenty-four hours a day, and even if it were possible it is desirable in some cases to leave some time for ventilation and defrosting battery-pipes. In such cases it is advisable to place no more warm fruit in a cool room than can be satisfactorily treated. If, therefore, the introduction of warm fruit is carried on until it is seen to be interfering with the cooling programme that has been decided on, then it would be better to hold any excess of fruit over in the packing-shed until the next day, rather than risk the safety of the main bulk already in store.

The beginning of the storage season calls for much greater efficiency in the plant than does any other time, and it is advisable that the outfit be capable of securing the requisite drop in flesh-temperature working much less than twenty-four hours a day. If under the various awkward conditions that confront the engineer at the beginning of the storage season this reduction in apple-flesh temperature cannot be accomplished, then the question arises as to whether the fans should not be increased in size and rendered capable of at least two speeds—one being greater than the existing speed. By this means

the rate of circulation could be accelerated, and consequently the efficiency of the plant per hour increased, without exceeding the minimum discharge temperature. The efficiency of the plant will require to be greater than to barely bring down the flesh-temperature the required amount per shift. For instance, if it is desired to reduce the flesh 10° in the first shift, then the actual reduction might require to be 13°, so as to allow, say, 2° rise while the plant is not working and, say, 1° rise during ventilation.

When the temperatures have been stabilized at the commencement of the season there is another consideration of much importance. As pointed out by Mr. N. B. Brown, engineer to the Nelson Freezing Company, if the machinery is capable of performing the required amount of work in a comparatively short time—say, with eight to twelve hours working per day—a fluctuation in the temperature of the air of the chamber can be secured without materially affecting the flesh-temperature, and such fluctuation will assist in the diffusion and equalization of the chamber-atmosphere and the atmosphere within each case, and will avoid the formation of pockets where gases accumulate or where the effects of the cooling process are not proportionately felt. The best time to apply the power will be during the hottest period of the day —say, 9 a.m. to 5 p.m.; but the period of running at the commencement of the season will be uncertain, the intake of fruit and other factors necessitating somewhat irregular hours of running to obtain the required result in the apple-flesh.

The use of, say, 4 in. by 2 in. timbers on the floor and battens between cases—both running with the air-current—is, of course, highly advisable to assist in the cooling and ventilating processes. For the same reason a space between the ceiling and the top of the stack, and between the walls and the stack, particularly at the discharge and suction ends, is necessary. Floor-to-ceiling circulation will, of course, require slightly different stacking from end-to-end circulation.

Ventilation.

The higher the apple-flesh temperature the more frequent will the ventilation require to be, because the more oxygen will be used by the fruit. Again, the more fruit there is in a store the less air will there be, and the more frequent will the ventilation require to be. The Cambridge Department of Industrial and Scientific Research has supplied invaluable information as to ventilation requirements. Apples consume oxygen, and simultaneously produce carbon dioxide equal in amount to that of the oxygen they have consumed. The Cambridge investigators have ascertained that so long as the atmosphere contains 8 per cent. or more of oxygen and 12 per cent. or less of carbon dioxide there is, under all conditions, no danger of flesh-collapse. They have, moreover, utilized the instruments for automatically recording the carbon dioxide in flue-gas in connection with detecting the amount of carbon dioxide in apple cool stores.

Before a standard method of procedure can be laid down for a given store it appears to be necessary that some idea should be gained of the rate of accumulation of carbon dioxide in that store at the commencement of the season. No doubt such an idea could be secured

from a few analyses with a Lunge's nitrometer, and it is proposed that this should be done. As a liberal arrangement it is also proposed that the store be thoroughly ventilated each day till the minimum apple-flesh temperature is reached, when twice a week may be sufficient, or less, according to the carbon-dioxide content shown to be in the air. The fresh air will, of course, be brought in by the fan from outside, and cooled and dried over the battery before delivery into the cool store.

The best time of day to ventilate will depend upon the weather. Two points, however, can be borne in mind. Firstly, ventilation would be the most valuable shortly before the end of the day's running, so that when the power is shut off and the chamber-atmosphere becomes stationary there would not be a large quantity of carbon dioxide or other by-products to settle or collect in any one place—for in several stores the main damage from flesh-collapse has occurred in fruit near the floor. Secondly, there will generally be a smaller percentage of moisture in the atmosphere from about 9 o'clock on to about 3 or 4 o'clock in the afternoon; but as the atmosphere cools in the afternoon, and on through the night, the percentage of moisture in the atmosphere will increase even to the point of precipitating dew.

Humidity.

It has not been suggested that humidity in itself is connected with flesh-collapse; nevertheless, it is quite certain that a little more attention to this factor will make for more favourable conditions to apples in cool store. For example, the average natural relative humidity at Nelson from May to September is 82, while cool stores are more often found to be at or close to saturation-point, or 100. Outside, with a relative humidity of 82 and a mean temperature of 48°, apples will keep without shrivelling in an ordinary shed till the end of August. With an apple-flesh temperature of 32°, they would keep longer in a relative humidity of 82 without shrivelling. At a relative humidity of 100, however, there is little chance of the apple disposing of any water, and any slight drop of temperature would result in the precipitation of moisture on any cold surface, and a consequent development of mould.

Now, shrivelling is not dependent entirely upon temperature and humidity. The apple itself as it becomes mature develops certain mechanism for the conservation of its water content. As, however, it is shown that too advanced maturity favours flesh-collapse, and there may consequently be a tendency for some growers to select fruit too much on the immature side, it would be wise to aim for a humidity a little above 82. I therefore propose a relative humidity range of 90 to 95, to be maintained during the hours of running. The use of the wet- and dry-bulb thermometers will show whether or not this is being accomplished. The collection of moisture from the atmosphere may be increased by increasing the rate of circulation, which will enable the battery-pipes to be run at a lower temperature without reducing the temperature of the discharge. This increase in the cooling-power of the plant per hour will result in a reduction of the number of running-hours per day.

In maintaining the requisite humidity it is, of course, essential in a dry system that the battery-pipes should be kept defrosted, and in a brine system that the requisite specific gravity of the brine should be maintained.

I would here acknowledge my indebtedness to the engineer of the Nelson Freezing-works, Mr. N. B. Brown, whose willing co-operation and advice have greatly assisted in this investigation.

NEW LIMESTONES FOR AGRICULTURAL USE.

NOTES ON THE YEAR'S SAMPLES.

B. C. ASTON, F.I.C., F.N.Z.Inst., Chemist to the Department.

THE interest which farmers and others engaged in primary production continue to manifest in lime deposits natural to each district is shown by the increasing number of samples which are yearly received for chemical analysis.

A promising feature of the results of such inquiries is the comparatively large number of deposits of soft calcareous matter which are coming to light. The use of such deposits in liming the land, thereby avoiding the necessity for grinding and possibly even bagging the material, has been from time to time advocated by the Chemistry Section, and has proved useful in some districts. What is aimed at is that where a farmer can utilize a soft deposit from his own or a local source he should do so, thereby relieving the State from the free carriage of lime over the railways and enabling the power which would thus be used to be employed in other directions.

The following is a selected list of the more useful limestones received during the past official year, the laboratory number being given as a key in each case:—

P 558 was a sample from a deposit found in the Mangamuka Gorge Road, Rawene, Hokianga. The deposit is small, but would be of considerable value, the sender thinks, when the road is completed. The deposit is on the Mangamuka River, just south of Block II, Section 7, Mangamuka. This is an excellent specimen of soft limestone, and, as it contains 93 per cent. carbonate of lime, if the deposit is similar to the specimen sent it should be of great value to lands requiring carbonate of lime.

P 624: This is a calcareous sinter containing 93 per cent. carbonate of lime, from the property of J. J. Ogle, Rangiahua, Hokianga. If there is much of this material available it would prove a valuable deposit. Unfortunately, these sinter deposits are frequently of small extent and soon worked out.

P 364–9, 85–8, and 126: These are a series of limestones forwarded from Oue, in the Hokianga district. They are usually weathered limestones with veins of calcite running through them. The samples

were small, and on account of their uneven character may not be strictly representative of the bulk of the deposit from which they are gathered, but they show that a suitable agricultural limestone could be obtained in that locality. The samples contained from 70 to 84 per cent. carbonate of lime.

P 525–7 are three samples of comminuted sea-shells classified as fine shelly grits, the finer ones containing 88 to 92 per cent. and the coarser one 85 per cent. of calcium carbonate. They are interesting in revealing an unusual source of carbonate of lime for agricultural purposes in the far North at Taumarere, in the Bay of Islands district. The finer samples would certainly be efficaceous as a dressing for soils requiring carbonate of lime.

P 398 is a sample of crystalline limestone from Dargaville, containing 96 per cent. carbonate of lime. It would make when ground to a powder an excellent agricultural limestone, and would also be suitable for " burning " into a quicklime.

P 363 is a hard limestone of the usual Whangarei type, and contains 88 per cent. carbonate of lime. P 130–4 are from Kamo, Whangarei, and contain from 75 to 85 per cent. carbonate of lime. Compared with the usual run of stones from North Auckland, they are distinctly good.

P 47 is a useful calcareous marl from Maungaturoto, Otamatea County, containing 72 per cent. carbonate of lime. It could be used for dressing lands without previous grinding, as it would readily disintegrate in the soil. P 596 is a similar stone to the last, from Paparoa, in the same county. It also contains 72 per cent. carbonate of lime.

P 28 is a marble-like hard limestone from Aria, Waitomo, and contains 98·5 per cent. carbonate of lime, suitable either for " burning " or grinding into a ground limestone.

P 372 is a calcareous sinter from Havelock North, containing 91 per cent. carbonate of lime.

P 342–3 are calcareous sinters forwarded from Napier (locality not stated), containing 93 per cent. carbonate of lime. They are soft and easily reduced to a powder, and would be eminently suitable for converting into ground carbonate of lime for agricultural use.

P 40–1 are calcareous sinters from Matainga Station, near Dannevirke. They contain 93 per cent. carbonate of lime. The remarks on P 342–3 also apply to these.

P 607 is a fairly coarse shelly grit deposit at Matamau, Dannevirke, containing 84 per cent. carbonate of lime. Without further grinding it would form a valuable source of carbonate of lime for agricultural purposes. Probably a preliminary screening to separate the coarser particles would increase its efficiency. The possibilities of this deposit are being further investigated.

P 515 is a calcareous sinter containing 87 per cent. carbonate of lime, from Te Pa, near Dannevirke, and would be an excellent source of agricultural carbonate of lime. It would weather down quickly if applied in an uncrushed condition.

P 54, from Te Rehunga, Dannevirke, is a very friable white limestone containing 96 per cent. carbonate of lime, and would require very little power to reduce it to a state suitable for application to the land. This is one of the purest and most easily ground limestones that have been submitted for examination.

P 62 is a soft granular deposit from Wanstead, Hawke's Bay, containing 91 per cent. carbonate of lime. It could be applied to the land as dug from the deposit, without further reduction. With very little treatment this material would make an excellent commercial ground limestone for agricultural use. P 164 is a sample from another deposit on the same property at Wanstead. This is a similar sample to P 62, but is slightly less pure.

P 334 is a sample of a deposit of soft carbonate of lime from Kaipara. It contains 72 per cent. carbonate of lime, and could be applied to the land as dug from the deposit. For the North Auckland west-coast district, where a high-grade limestone is somewhat difficult to obtain, this should be a particularly useful deposit.

P 397, from Moerangi, Kawhia, is a hard crystalline stone containing 86 per cent. carbonate of lime. If the specimen is a representative one the stone is adapted to the production of "burnt" lime, as well as for grinding for agricultural use.

P 10, from Charleston, Westport, is a limestone of good quality, containing 95 per cent. carbonate of lime. It would produce a ground limestone of the first grade, and could be calcined to a quicklime of good quality.

P 580 is a sample of dark reddish-brown limestone from Taylor's Pass Road, Wairau Valley, Marlborough, containing 91 per cent. carbonate of lime. This is a hard, crystalline stone containing small amounts of iron and manganese.

P 214, from Mount Lud, Kaikoura, is a soft chalk-like deposit containing 96 per cent. carbonate of lime. If available in quantity this would be a valuable source of carbonate of lime for agricultural purposes. In addition to its agricultural value this material is worth testing in the manufacture of putty and for similar purposes. This sample contains the remains of similar organisms to those found in true chalk.

P 567 is a white chalky sample from Waikari, North Canterbury. It contains 73 per cent. carbonate of lime.

P 7, from Hampden, Otago, is a hard crystalline limestone containing 98·5 per cent. carbonate of lime.

P 191 is a soft carbonate of lime from Otekaieke, Oamaru, which would form an excellent dressing for soils needing carbonate of lime. It contains 82 per cent. carbonate of lime.

P 74 is a hard white crystalline stone of very high grade, from Milburn, Otago. It is exceptionally well suited to calcining to quicklime, or would make an agricultural ground limestone of the highest grade. It contains 98·5 per cent. carbonate of lime.

Breeding of Geese.—A correspondent asks how many geese may be mated to each gander. In order to secure the best results not more than two or three geese should be kept with one gander.

MANURIAL TRIALS WITH WHEAT AT CARTERTON.

F. W. GREENWOOD, B.A., Instructor in Agriculture, Wellington.

For the past two seasons the Department has conducted a manurial trial with wheat on the farm of Mr. M. C. Jansen, at Carterton, in the Wairarapa district. The ground selected for experiment was a fairly heavy loam having at a depth of from 9 in. to 12 in. an ironstone subsoil. The land was worked out of the lea, being skim-ploughed in June and cross-ploughed late in July, 1922. Lime in the ground carbonate form was applied at the rate of 1½ tons per acre in August on part of the area (plots 6 to 9). The wheat was sown early in September, the variety being Solid-straw Tuscan. Manure, where applied, was sown at the same time as the wheat, from the manure-box of the drill.

GENERAL VIEW OF THE WHEAT CROP ON MR. JANSEN'S FARM: SECOND SEASON.

During the growing-period of the first season there were no marked differences to be seen among the various plots. During the second season, however, when the same variety of wheat was sown, but neither lime nor manure again applied, marked differences were perceptible, as the following notes made in January, 1923, on the occasion of a farmers' field-day, will show :—

Plot 1, control : On this plot the crop is fair, except on one corner where the proximity to some gum-trees has accounted for the total absence of growth.

Plot 2, Nauru ground rock phosphate : The wheat on this plot has headed far better than has that on No. 1, where neither lime nor manure has been used. A much larger percentage of this wheat shows signs of rapidly approaching maturity.

Plot 3, Nauru superphosphate: The growth of straw on this area has been prolific, but the wheat is less advanced.

Plot 4, Nauru ground rock mixed with superphosphate: From all appearances this is the best plot in the paddock. It is maturing evenly, has stooled excellently, is full in the head, and at the same time fairly fine in the straw.

Plot 5, control: This untreated plot was green as compared with the whiteness of the adjoining plot No. 4.

Plot 6, limed control: The wheat here was more advanced than on No. 5, but less so than on the manured plots.

Plot 7, Nauru ground rock used after lime: The result on this plot, to all present appearances, is much better than that on No. 2, where rock phosphate was used alone.

Plot 8, superphosphate used after lime: This plot appears to be the next in quality to that on which the mixture of rock phosphate and superphosphate has been used.

Plot 9, limed control: This plot has a gentle slope, and the surface is much nearer to the ironstone than on other plots. Last year there were many patches upon which wheat did not grow at all. This year the whole plot is well covered, and the wheat crop is considerably better. This indicates that the lime is beginning to show its effects.

The yields obtained for the two seasons were as follows:—

Plot.	Treatment.	Area.	Season 1921-22: Yield per Acre.	Season 1922-23: Yield per Acre.
		Acre.	Bushels.	Bushels.
1	Control	1	29·4	31·2
2	Nauru ground rock, 1½ cwt. ..	1	36·1	40·3
3	Nauru superphosphate, 1½ cwt. ..	1	36·9	41·5
4	Nauru rock, 1 cwt., and Nauru super ½ cwt.	1	42·4	45·6
5	Control	½	37·6	40·9
6	Limed control, 1½ tons	½	38·9	41·9
7	Nauru rock, 1½ cwt., and lime, 1½ tons	1	39·5	43·3
8	Nauru super, 1½ cwt., and lime, 1½ tons	1	37·1	42·1
9	Limed control, 1½ tons	1	25·4	34·4

As already indicated, the soil of plot 1, being in close proximity to a group of gum-trees, is poorer than that of the adjoining plots. In the case of plot 9 the ironstone comes nearer to the surface than it does on the other plots, owing to the fact that the surface soil slopes steeply away. The soil here, moreover, is wetter and sourer than is that of the adjoining plots. For these reasons it is evident that plots 1 and 9 cannot justly be compared with other plots in the paddock. The soil on all the other plots is sufficiently uniform to allow of comparisons being made. It must be noted, however, that in the case of plot 9 (the limed control) the yield this season (34·4 bushels per acre) as compared with that of last season (25·4 bushels per acre) shows an advantage of slightly over 26 per cent. This is probably due to the fact that the lime is beginning to act in a place where its need was so manifest.

Apart from the difference secured in the latter instance, the results obtained from liming in this experiment are very inconclusive. The results obtained from Nauru rock and superphosphate do not show high margins over and above the untreated plot in the centre of the paddock. The most successful result is that obtained from the use of a mixture of 1 cwt. Nauru rock phosphate and ½ cwt. Nauru superphosphate.

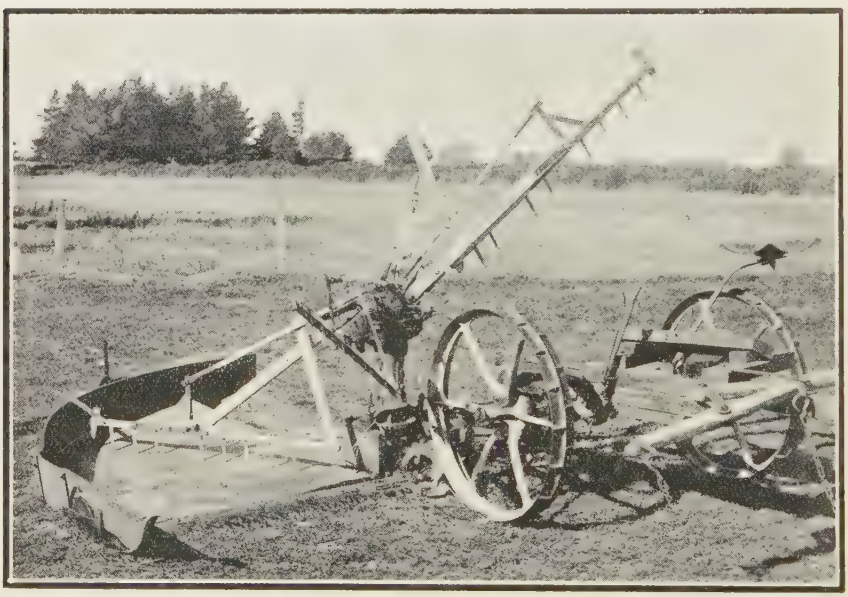
It will also be noted that in every case the yields have been higher this year, when no manure was applied, than they were last season, when the land was ploughed out of the lea and both manure and lime were applied. It is evident that in the 1921–22 season the ground was somewhat too strong to admit of successful wheat-growing.

Trials regarding the effect of Nauru phosphates on wheat have also been conducted on the farm of Mr. D. Smith, Masterton.

AN IMPROVED WHITE-CLOVER CUTTER.

THE accompanying photograph illustrates how Mr. C. Woodfield, of Horrelville, Canterbury, has contrived, with a very large measure of success, to adapt a mowing-machine for harvesting white clover.

The ordinary side-delivery machine does not cut close enough to the ground to catch all the heads, while the speed of the knife is too slow to cope with the heavy swath of green undergrowth. Mr. Woodfield's aim was to combine the close-cutting virtue of the grass-mower with the collecting and windrowing mechanism of the side delivery. To gain these points he inverted an ordinary mowing-machine, and with the aid of a special casting brought the knife behind instead of in front of the mower-wheel. A specially constructed platform mounted



MR. WOODFIELD'S WHITE-CLOVER CUTTER.

Showing sweep in position to deliver the crop from the platform, while the other sweeps are folded to clear the mower-wheel and the driver.

upon three small wheels is attached to the knife-bar, and sweeps to collect and deliver the clover are attached to the centre-mounting on this platform and driven by means of a chain direct from the main axle of the mower. A seat is fitted to one side, giving a view of both the horses and the mower, and by means of a special folding-device the sweeps are raised to clear both the mower-wheel and the driver as they pass. The platform is fitted with a box covered with perforated zinc to catch the threshed seed which invariably falls on the journey from the knife to the windrow, and it is contended that the expenses of harvesting are often collected in this box. A wire connects the trip to a pedal on the footboard, thus enabling the operator to trip the machine when required and so sweep the cut clover into rows behind the mower.

The photograph was taken when the machine had just finished its fourth season, having cut a total of 250 acres. The marks of hard wear are apparent in many places, while the toothless condition of some of the sweeps bears testimony of work under many adverse conditions.

—*F. E. Ward, Instructor in Agriculture, Christchurch.*

THE KING AND AGRICULTURE.

DURING the recent visit of the King and Queen to Rome they visited the International Institute of Agriculture. In replying to an address of welcome by the President of the Institute, the following interesting remarks were made by His Majesty:—

"The agricultural industry is of vital and universal importance, for it provides not only the actual necessities of life, but a firm foundation of social and political stability, while ensuring to a thrifty and industrious population a life under the healthiest of natural conditions. Hence the welfare and prosperity of the agricultural community is a matter of deep concern to the Government and people of every country. I take a personal and active interest in the fortunes and misfortunes of the industry not only in my own country and in the British dominions, but throughout the world. I am fully aware that, in addition to the uncertainties at all times inherent in agriculture, the industry to-day has to combat special difficulties owing to the severe fall in prices resulting from the Great War upheaval. My sympathy goes out to my fellow-agriculturists in their trials and anxieties; but I do not despair, believing that their traditional patience, courage, and enterprise will again carry them triumphantly through this present crisis. After the ravages of war the way to peace and prosperity is uphill and devious, and perhaps the best and most direct path is to be found along the lines of international co-operation, so admirably followed during the past eighteen years by the International Institute of Agriculture. One of the main functions of the Institute is to supply farmers in all countries with the latest information, practical as well as that based upon scientific research. Year by year the necessity for such an organization is more generally recognized throughout the British Empire, and the adoption by the Governments and the agriculturists of these up-to-date methods augurs well for the industry's future. Doubtless the same spirit is manifesting itself in this beautiful land of Italy as elsewhere. In these and other directions the achievements of the International Institute of Agriculture must always be of special value, and the Queen and I are happy to have the opportunity of inspecting its work. I shall always watch with interest the progress of the Institute, confident that, favoured by the generous support which it has invariably received from His Majesty the King of Italy, and with the hearty co-operation of the adhering States, it will continue to render great services to the most essential and ancient of all industries."

GRADING OF EXPORT BUTTER AND CHEESE.

LEADING FACTORY AVERAGES FOR 1922–23.

W. M. SINGLETON, Director of the Dairy Division.

FROM time to time the Dairy Division receives requests from dairy company secretaries, factory-managers, and others interested for the season's average grade of the factory with which they are connected. Credit is due to those dairy companies which have exported produce attaining a high average grade for the season. It is also recognized that other companies are endeavouring to improve the quality of their output, and in such cases the chance of having their names included in a published list will provide some additional stimulus. The average grades for 1922–23, tabulated below, represent very meritorious work, and the New Zealand dairy industry is fortunate in being in a position to show such a list of factories with averages of 92 points or more for butter and 91 points or more for cheese.

BUTTER-FACTORIES WITH AN AVERAGE GRADE OF 92 POINTS AND OVER FOR YEAR ENDED 31ST MARCH, 1923.

Name of Company.	Registered No.	Brand.	Average Grade.
Auckland Grading-station.			Points.
Kaitaia	1298	Kaitaia	93·95
Piopio	603	Piopio	93·89
Kaitieke	1119	Kaitieke	93·74
Waipu	1248	Waipu	93·64
Cambridge	1239	Cambridge	93·52
New Zealand (Frankton Junction No. 1)	1510	Anchor, &c.	93·50
Whangarei	1720	Kauri	93·50
Maungaturoto	1407	Maungaturoto	93·48
Waitanguru	1154	Golden Gem	93·45
Oruru-Fairburn	1337	Fairy	93·42
Whangaroa	658	Whangaroa	93·41
Kaipara	794	Poplar, &c.	93·21
Hikurangi	303	Hikurangi	93·09
Northern Wairoa	1358	Northern Wairoa, &c.	92·80
Ruawai	66	Ruawai	92·77
Aria	1734	Aria	92·75
Mercury Bay	485	Mercury Bay	92·72
New Zealand (Frankton Junction No. 2)	1880	Anchor, &c.	92·69
New Zealand (Ngaruawahia)	22	Anchor, &c.	92·58
Maungatapere	1710	Moana	92·54
New Zealand (Waiuku)	111	Anchor, &c.	92·53
New Zealand (Waihou)	1458	Anchor, &c.	92·51
Bay of Plenty	1399	Bay of Plenty	92·51
New Zealand (Ngatea)	291	Anchor, &c.	92·47
Hokianga	1843	Hokianga	92·47
New Zealand (Pukekohe)	109	Anchor, &c.	92·36
Waitemata	332	Waitemata	92·33

BUTTER-FACTORIES—*continued.*

Name of Company.	Registered No.	Brand.	Average Grade.
	Auckland—continued.		Points.
New Zealand (Tuakau) ..	1320	Anchor, &c.	92·27
Kaitieke (Matiere)	1698	Suprema	92·26
Amburys	392	Butterfly	92·07
New Zealand (Otorohanga) ..	185	Anchor, &c.	92·03
	New Plymouth.		
Maketawa	342	M.D.C.	95·07
Tarurutangi	728	Champion	94·57
Bell Block	488	Bell Block	94·52
Midhirst	110	Rugby .. .	94·35
Mangorei	345	Mangorei	94·03
Mangorei	345	Milklads	93·93
Omata	82	Lily	93·46
Lepperton	49	Lepperton	93·31
North Taranaki	723	Flax	92·95
Tikorangi	102	Shield	92·79
Stratford	68	Good Luck ; Three Star	92·62
Eltham	31	Eltham	92·58
Waitara	726	Waitara	92·41
Ngaere	25	Triumph	92·18
Tariki	1818	Tariki	92·13
Kaponga	732	Kaponga	92·10
	Patea.		
Mells	764	Mells	94·07
Manutahi	495	Manutahi	93·68
Kakaramea	630	Penguin	93·02
Hawera	346	Federation	92·34
Pihama	627	Pihama	92·30
Alton	1890	Alton	92·04
Riverdale	106	Trident	92·02
Meremere	316	Meremere	92·00
	Wanganui.		
Cheltenham	3	Pakeha	93·45
Wangaehu	1326	Wangaehu	92·43
Rangitikei	1360	Rangitikei	92·33
	Wellington.		
Levin	910	Lake	94·68
United	1220	Whariti	94·10
Rata	938	Rata, &c.	94·07
Riverbank	985	Riverbank	93·91
Taihape	1188	Tikapu	93·83
Shannon	1489	Shannon	93·78
Mauriceville	14	Mauriceville	93·65
Awahuri	664	Red Rose	93·48
Raetihi	717	Raetihi	93·47
Cheltenham	3	Pakeha	93·22
Featherston	360	Featherston	93·16
Manakau	815	Manakau	93·11
Murchison	1888	Airship	93·05
Karamea	1570	Karamea	93·02
Rangitikei	1360	Rangitikei	93·02
Heretaunga	1230	Heretaunga	92·97
Masterton	1307	Masterton	92·95
Kaikoura	302	Kai	92·88

BUTTER-FACTORIES—*continued.*

Name of Company.	Registered No.	Brand.	Average Grade.
	Wellington—continued.		Points.
Rangiwahia	750	Quail	92·86
Konini	1203	Konini	92·75
Waiaruhe	268	Arrow	92·75
Wellington City Municipal Milk	202	Rahui	92·64
Apiti	414	Apiti	92·62
Golden Bay	146	Sovereign	92·62
Pahiatua	140	Scarborough	92·51
Tamaki	1463	Chimes	92·39
Norsewood	600	Norsewood	92·24
Kairanga	1768	Longburn	92·15
Rongotea	8	Rongotea	92·12
Otaki	1236	Otaki	92·06
	Lyttelton.		
Akaroa	1579	Akaroa	93·56
Kaikoura	302	Kaikoura	93·34
Sefton	28	Sefton	93·19
Kiwi	299	K.D.C.	93·10
Tai Tapu	175	Tai Tapu	92·93
Canterbury Central	55	Fern-leaf	92·54
Caroline	236	Caroline	92·19
	Dunedin.		
Waitaki	812	Waitaki	94·37
Taieri and Peninsula	54	Peninsula	92·78

CHEESE-FACTORIES WITH AN AVERAGE GRADE OF 91 POINTS AND OVER FOR YEAR ENDED 31ST MARCH, 1923.

Name of Company.	Registered No.	Brand.	Average Grade.
	Auckland Grading-station.		Points.
Opouriao	1169	Opouriao	92·77
Horsham Downs	1089	Horsham Downs ..	92·31
New Zealand (Akaaka) ..	121	Anchor, &c.	92·15
Cambridge (Leamington) ..	126	Leamington	92·11
Cambridge (Monavale) ..	127	Monavale	91·75
New Zealand (Orini)	115	Anchor, &c.	91·64
New Zealand (Gordonton) ..	186	Anchor, &c.	91·57
Bruntwood	1534	Bruntwood	91·49
Kakepuku	83	Kakepuku	91·42
New Zealand (Okoroire) ..	189	Anchor, &c.	91·40
Tatua	34	Tatua	91·34
New Zealand (Rukuhia) ..	114	Anchor, &c.	91·29
New Zealand (Matatoki) ..	177	Anchor, &c.	91·23
Cambridge (Victoria Road) ..	124	Victoria Road ..	91·19
New Zealand (Manawaru) ..	77	Anchor, &c.	91·13
Waimana	1817	Waimana	91·07

CHEESE-FACTORIES—*continued.*

Name of Company.	Registered No.	Brand.	Average Grade.
		Moturoa.	
			Points.
Tariki	1700	Tariki	92·96
North Taranaki (Waipapa)	212	Flax	92·95
Pembroke	234	Pembroke	92·58
North Taranaki	723	Flax	92·17
Okato (Puniho)	48	Puniho	92·15
Kaimata	992	Oaks and Ash	92·12
Kaponga	1694	Kaponga	92·12
Tuna	209	Tuna	92·01
Bell Block	488	Bell Block	91·96
Tariki (Rugby Road)	216	Miro	91·93
Okato	85	Okato	91·76
Patua	73	Patua	91·64
Kaponga (Rowan)	1696	Rowan	91·64
Oaonui	491	Gem	91·63
Okato (Leith)	57	Leith	91·61
Royal Oak	693	Royal Oak	91·43
Frankley Road	201	Frankley Road	91·40
Kaponga (Riverlea)	1695	Riverlea	91·39
Waitoitoi	20	Waitoitoi	91·14
Warea	87	Warea	91·14
Cape Egmont	632	Cape Egmont	91·06
Eltham (Jerseydale)	1031	Jerseydale	91·03
		Patea.	
Pihama	627	Pihama	92·48
Pihama (Skeet Road)	1111	Pihama	92·45
Mangatoki	136	Mangatoki	92·40
Mangatoki (Matapu)	1087	Mangatoki	92·35
Kaupokonui	633	Kaupokonui	92·30
Alton	1890	Alton	92·18
T. L. Joll (Okaiawa)	1727	Maori Chief	92·13
Kaupokonui (Katua)	1733	Katua	91·94
Kakaramea	630	Penguin	91·94
Mangatoki (Kaponga)	256	Mangatoki	91·64
Riverdale	106	Trident	91·63
Kaupokonui (Oeo)	1132	Oeo	91·54
Pihama (Waiteika Road)	1112	Pihama	91·47
Kaupokonui (Kapuni)	1629	Kapuni	91·35
Kohi	923	Kohi	91·24
Kaupokonui (Sutherland)	176	Sutherland	91·21
Kaupokonui (Skeet)	174	Skeet	91·02
Waverley	1834	Oturi	91·00
		Wanganui.	
Rapanui	1714	Southern Grove	91·03
		Wellington.	
Te Horo	134	The Allies	93·51
Kuku	905	Ohau	93·43
Norsewood (Ngamoko)	196	Norsewood	92·75
Ballance	1	Ballance	92·74
Nireaha	335	Nireaha	92·54
Hukanui	27	Hukanui	92·49
Norsewood (Makotuku)	135	Norsewood	92·33
Norsewood	1758	Norsewood	92·24
Maharahara	984	Maharahara	92·04

CHEESE-FACTORIES—*continued.*

Name of Company.	Registered No.	Brand.	Average Grade.
	Wellington—continued.		Points.
Tamaki	58	Big Ben	91·90
Marima	195	Marima	91·88
Kairanga	182	Kairanga	91·78
Kiritaki	1521	Premier	91·73
Mangaroa	252	Onward	91·57
Glen Oroua	906	Glen Oroua	91·45
Tamaki	1463	Bell	91·39
Manakau	815	Black Swan	91·33
Rongokokako	1280	Rongo	91·19
Kokotau	809	Kokotau	91·02
	Lyttelton.		
Little Akaloa	32	Little Akaloa	92·93
Milford	267	Milford	92·87
Temuka	207	Ohape	92·79
Staveley	1719	Staveley	92·17
Wairewa	471	Wairewa	91·98
Barry's Bay	401	Onawe	91·59
O'Kain's Bay	239	Milford ; O'Kain's Bay	91·08
	Dunedin.		
Omimi	74	Omimi	92·43
Milton	1030	Milton	91·92
Momona	1010	Alianton	91·65
Mosgiel	161	Mosgiel	91·55
Stirling	292	Stirling	91·55
Paretai	271	Paretai	91·45
	Bluff.		
Waianiwa	1171	Waianiwa	93·13
Tuturau	132	Tuturau	92·92
Edendale	36	Edendale	92·86
Brydone	1821	Brydone	92·75
Island	72	Island	92·55
Wright's Bush	206	Wright's Bush	92·48
Thornbury	1581	Thornbury	92·39
Boggy Burn	703	Boggy Burn	92·23
Wyndham	59	Wyndham	92·19
Rimu	1155	Rimu	92·19
Mataura	38	Mataura	92·15
Seaward Downs	702	Seaward Downs	92·10
Tisbury	701	Tisbury	91·99
Menzies Ferry	623	Menzies Ferry	91·96
Switzers	802	Switzers	91·96
Pukerau	480	Pukerau	91·91
Whiterig	798	Whiterig	91·89
Kennington	205	Kennington	91·85
Woodlands	1485	Woodlands	91·81
Pine Bush	543	Pine Bush	91·78
Otautau	1610	Otautau	91·71
Aparima	188	Aparima	91·68
Freshford	1224	Freshford	91·60
Morton Mains	1604	Morton Mains	91·54
Lochiel	659	Lochiel	91·03

SEASONAL NOTES.

THE FARM.

CULTIVATION.

With the arrival of August the preparation of land for spring crops must be pushed along as conditions of soil and weather will allow. For root crops such as carrots and mangolds the ploughing should be as deep as the nature of the land permits, provided always that the sod can be properly turned under. Virgin land, such as newly stumped areas, intended for swedes or turnips should also be ploughed as early as possible. Early ploughing allows the turned-under material time to rot and form a union with the subsoil, which ensures a good supply of moisture during the hot summer months by capillary attraction. For wheat the seed-bed should be worked deeply. The cultivator does better than the disk, as it works the fine soil down and brings the clods to the surface. These afford shelter for the young plants, and are later broken down by the roller.

CEREAL CROPS.

Generally speaking, the end of August is quite early enough for sowing spring wheat. In order to make up for the lesser amount of tillering, a heavier seeding than with autumn-sown is required, about 2½ bushels per acre being the correct thing. Superphosphate, from 1 cwt. to 2 cwt. per acre, is a suitable manure. Spring-sown cereals in general are more susceptible to disease than those sown in autumn, and all seed-wheat should be dressed for smut before sowing. The best dressing is the ordinary 40-per-cent. formalin as supplied by chemists, at the rate of 1 pint to 40 gallons of water. Spread the wheat out on a floor and sprinkle with spray-pump or watering-can until all the grain is wet, using a shovel to do the necessary turning. The grain should be left on the floor all night and bagged in the morning. Any wheat which may happen to be left over when sowing is completed can be used for fowl-feed, there being no danger from poisoning.

The standard wheats for South Island grain-growing districts need hardly be mentioned here. Among the best varieties for North Island conditions are Major, Marquis, and John Brown. During the last two seasons in several districts Major has beaten all other varieties for yield, and has the great advantage that the straw is very strong and will stand up on most lands. Besides this, it is a quick-maturing wheat, and may be sown as late as the first week in October.

Oats and early barley also may be sown in August. Cape or (if obtainable) Black Skinless barley can be put in for spring feed.

Where it is intended to carry on an autumn-sown cereal crop for grain, chaff, or hay the final feeding should in most cases be done by the end of August, the exceptions being very strong land where there is a danger of the crop growing too much straw and lodging. In such situations feeding-off may often be profitably carried on until the end of September. After the final feeding the field should be given one or two strokes of the tine harrows. This will open the land and greatly hasten subsequent growth. If the crop has not been previously manured and appears somewhat thin or weak 1 cwt. of superphosphate per acre, applied before or during the harrowing, will greatly benefit it, and often means the difference between a profitable crop and a failure.

SPECIAL CROPS FOR HAY OR ENSILAGE.

In dry situations these may be sown towards the end of August, but generally September is early enough. Mixtures of oats and tares, oats and peas, and wheat and tares or peas are the most suitable; but where wheat is used instead of oats the tares seem to do better. As a general rule the sowing is at the rate of 2 bushels of the cereal to one of tares or peas. Golden tares are the best for spring sowing, but the ordinary grey does quite well. Grey Partridge or Early Minto are good varieties of peas. Suitable manures are basic super, super, or mixtures of half super and half Nauru phosphate or basic slag, 1 cwt. to 3 cwt.

per acre according to the quality of the land. Except in the case of very light land, manures containing nitrogen are not recommended.

TOP-DRESSING OF PASTURES.

This should have been already completed, but if there has been delay the work may still be carried out. When quick results are desired the top-dressing should consist of superphosphate, basic super, or lime and super. Where there is plenty of moisture basic slag may still be applied with fairly satisfactory results, but if the conditions are dry, dependence should be placed on one of the first two manures mentioned. On most dairy farms hay and roots will still be fed out and stock-droppings accumulating; it will therefore be necessary to keep the tripod or chain harrow going to keep these distributed.

FEEDING OF ROOTS AND GREEN CROPS.

Swede crops will now be getting past their best, and where mangolds have been provided a start will be made to feed them. For ewes, either before or after lambing, they are excellent. The ewes may be turned on to breaks where the roots have been previously pulled or harrowed out, but it is better for the ewes, and the mangolds will go a great deal further, if they are carted out on to a nice clean grass-paddock. Under these conditions there is little danger of the ewe eating too much. There are not many forages that ewes will milk better on than properly ripened mangolds.

With dairy cows the feeding of mangolds should be fairly light for the first few days. For cows in profit one can start with 20 lb. per cow per day, increasing the allowance to 50 lb. or 60 lb. at the end of a week. Cows that have not yet come into profit should not receive more than 40 lb. per day. Always provide a liberal supply of hay, and feed this before the roots.

In many cases cows as they come into profit will be given from about half an hour daily on green oats or other cereal crops. Care should be taken to see that they are not on too long for the first few days, particularly if the weather is wet and cold; if allowed to eat too much under these conditions there is considerable danger of redwater. With judicious feeding and plenty of good hay the danger is reduced to a minimum.

—*Fields Division.*

SOME LAMBING HINTS.

It is good practice to have two paddocks shut up for a while prior to lambing-time. Into one of these can be turned the ewes with one lamb, and into the other the ewes with twins. The latter should have the paddock with the better growth of feed, if there is any difference.

In many cases, more especially with flocks of up to, say, 2,000 ewes, it is very convenient to have a small yard with a few lambing or mothering pens. The yards should be fenced off in the corner of the lambing-paddock, with strong stakes driven well into the ground and just the length of a hurdle apart. Wire the hurdles to the stakes, leaving a gateway close to the main fence. Then make up bundles of straw or brush and stand them on end on the other side of the fences, particularly on the side that the prevailing wind comes from during the lambing-period. Tie the bundles there with light wire, flax, or binder-twine, also round the part where the hurdles are fixed. Now fix up the pens, which will require to be large enough to allow the ewe to move about comfortably. Fasten one end of the hurdle to the fence where the straw is placed, and drive in a stake to fasten the other end to. Having fixed up the number required, put another hurdle across the front, making one end secure and leaving the other loose until the pen is required for use. Put a few rails or battens along the tops of the pens and place straw on these. This forms a roof and helps to keep the ewe quiet when put in, besides giving her and the lamb protection from rough weather. This sort of lambing-yard will be found especially useful for merino ewes that have been mated with longwool rams.

When a ewe requires assistance drive her up to the yard quietly, give the necessary attention, and put her and the lamb into one of the pens, closing and fastening the gate. Sometimes a ewe can be assisted out in the field and will remain with the lamb, but in some cases the lamb is deserted and has to be penned with its mother if practicable. When a lamb dies after being dropped it should be skinned, the carcase buried, and a lamb should be taken away from a ewe which has more than one. Then pull the dead lamb's skin over the live one, and put the lamb in one of the pens with the ewe which has lost her own until she mothers it

With most of the longwoolled breeds the following plan can be adopted with safety. When going among the ewes that are lambing carry a supply of binder-twine and a few dog-collars. Catch any ewe that has left her lamb and will not take to it, put a collar round her neck, and fasten her with a short length of twine to a stake or a post in the fence, leaving her there until she has taken to the lamb properly. This allows the lamb to draw the milk without being knocked about. The same can also be done with a ewe which has lost her lamb, and with which it is intended to put a foster-lamb. When the ewe has taken to the lamb they can be let go.

—*J. G. Cook, Live-stock Division.*

THE ORCHARD.

EARLY SPRING WORK.

THE stone-fruit trees will commence to make new growth early in August, and the pip-fruits at the beginning of September; the respective prunings, generally, should be completed before those dates. This operation affords an excellent opportunity for the close inspection of individual trees. Full advantage should be taken of this opportunity to mark trees specially infected with disease, to carefully pull any suckers growing from the roots, to treat any large branches that are broken or sprung, and to trim wounds made by implements and give them a dressing of tar.

Just before the buds of the stone-fruit trees start to swell an application of bordeaux, 8–6–40, should be made for the prevention of leaf-curl, brown-rot, and shot-hole fungus—all serious diseases to which these trees are prone. Trees of this kind suffering from scale or aphis parasites should be further sprayed with red oil, 1–20, before bud-movement. Further spraying of orchard-trees can then be deferred until September. There is only one way of mixing bordeaux spray effectively, and that is to dissolve and fully dilute each ingredient before mixing. It is a little troublesome to place diluting-tubs on hand in a suitable position, but once this is done the correct method is as quick as any other way.

Considering the amount of spraying to be done, growers accustomed to fill their spray-tanks through small taps or by bucketing water out of creeks or dams are strongly recommended, on the score of economy, to adopt better methods as soon as possible. Elevated water-tanks with a 2 in. faucet form the best method of supply, but where water has to be picked up from dams or creeks a good horizontal hand-pump should be used.

The orchard should be ploughed now as soon as it is sufficiently dry; make a clean neat job, turning the land over close up to the trees and carrying the ploughing as near the fences as it is possible to get.

An important factor in successful modern horticulture is the proper use of manures. Varieties of orchard-trees such as are grown in this country, selected for early maturing and heavy cropping, cannot maintain these characteristics without generous manuring. Neglect in this respect means a debilitated tree, susceptible to disease and easily burnt by sprays. A very satisfactory treatment has been to harrow in a dressing of superphosphate and sulphate of potash after the first ploughing, followed by a dressing of nitrate of soda or sulphate of ammonia as the trees come into blossom; but, of course, each orchard must be studied separately if successful manuring is to be accomplished. Locality, pervious treatment, and kinds and varieties of trees are some of the points which have to be taken into consideration. Strong-growing Winter Cole pear-trees obviously do not want the forcing of nitrates as do rather stunted Sturmer apple-trees. If in doubt the local Orchard Instructor may be consulted in this matter. Trees that are well conditioned by proper feeding with manures are more resistant to disease, and will stand stronger sprays and bear fruit of superior quality.

Any planting contemplated is best finished during this month. Hares and rabbits are usually troublesome at this season of the year, especially among young trees; they do not confine themselves to these, however, in a hard season. Almost any spray applied to the butts and lower branches renders these distasteful, and is an effective deterrent.

Keep a close watch on fruit in store, and note developments. The last of the earlier varieties should be cleared during this month.

—*W. C. Hyde, Orchard Instructor, Nelson.*

FIREBLIGHT.

Now that the pruning season is at hand all growers of pip-fruit trees in any part of the Dominion, whether they are resident in an area in which fireblight is known to exist or not, are warned to keep a sharp lookout while engaged in pruning operations for any suspicious cankers on apple, pear, or quince trees. Past experience of the hold-over canker of this disease goes to show that delay in removing any parts which may appear suspicious is extremely dangerous. Even if a canker attacking a pip-fruit tree should be proved not to be a fireblight hold-over canker it would undoubtedly be better removed and immediately burnt.

When the canker has been removed, cut well below the bark or cambium discoloration and thoroughly sterilize the wound by swabbing with the formalin solution mentioned below, or a mixture consisting of 1 part corrosive sublimate to 1,000 parts of water—that is, one tabloid to 1 pint of water. Apply with a small brush. The latter is a deadly poisonous compound, and every care should be taken in its use. After sterilizing the wound should be painted with a mixture of creosote and tar.

When engaged in the work of removing suspicious cankers from fruit-trees all knives, secateurs, &c., used in the operation should be sterilized after each cut by immersion in a solution of 1 part formalin diluted with 20 parts of water.

Growers in any part of the Dominion are reminded that it is as well to keep a sharp lookout for fireblight-infected hawthorn in any hedges adjacent to their property, and if any doubt exists as to the actual infection of any part or parts of a hedge the advice of the local Orchard Instructor should be sought.

—J. W. Collard, Orchard Instructor, Auckland.

POULTRY-KEEPING.

HATCHING-TIME.

Poultry-keepers who have not commenced hatching operations are reminded that August and September are the best months to have the chicks hatching out, those brought out later than this seldom proving satisfactory. No time, therefore, should be lost in securing the required number of stock. In many cases, of course, hatching operations will be delayed till October, or even later, owing to inability to secure broody hens. The poultry-keeper who is really anxious to secure the greatest profit from his undertaking will, however, not waste time waiting for broody hens, but will adopt artificial methods, and thereby be able to have all his stock hatched out at the right time. It is now recognized that the maximum returns cannot be secured from poultry unless late autumn and winter eggs are produced in good numbers. It is also recognized that the pullets must be chiefly depended upon to produce these, and to do so they must be hatched out early.

This involves the adoption of artificial methods, as on most plants it is impossible to secure the desired number of broodies when they are required. Even on the farm artificial methods must be resorted to. The chief reason why the farmer does not get winter eggs is because the greater number of the fowls kept by him have passed their best period of production, or that, having been bred at the natural season, the birds lay when nature dictates and take a rest during the dear-egg season. While a variation of price between summer and winter eggs will always be experienced, there is no reason why the selling-price should fluctuate between 1s. and 3s. 6d. per dozen.

FARM POULTRY AND ITS POSSIBILITIES.

The last census returns showed that there were 3,991,009 head of poultry stock in the Dominion, and that the average flock consisted of two dozen birds. Obviously, this goes to show that the great bulk of the poultry in the Dominion is on the farms. Nevertheless, it is safe to say that few high-priced eggs come from the farmer. They are chiefly supplied by poultry-keepers who specialize in the business, hatching eggs from tested stock at the right time, and feeding and managing their birds on the best principles. Of course, the extra profit made on winter eggs justifies the special effort to secure them. No doubt farms in general,

or at least the womenfolk of the farm, find the keeping of poultry a profitable side-line, having regard to the general low cost at which the fowls are maintained. The present revenue, however, is nothing to that which would be secured were the farm poultry handled to the best advantage.

If more eggs are to be secured next autumn and winter the farmer must, first of all, guard against having late-hatched stock. Even with light breeds such as Leghorns, the birds will not lay till the spring if brought out later than September. It is always better to hatch out on the early side rather than on the late side. It should be always remembered that the laying-year ends with the moult, so that the late-hatched bird has no opportunity, having regard to the short season available, of producing a good egg-yield during the pullet-year.

Where it is not convenient to use incubators a good means for the man in a small way to overcome the drawback to timely hatching is the facility now being offered of securing day-old chicks from reliable breeders of high-type laying stock. With fireless brooders, where the necessary attention is available, these chicks can be satisfactorily brought to maturity. Chickens can thus be secured at a season when they will have every opportunity of developing well, and of coming to their laying season at the most profitable stage of the egg-market. On the small plant the day-old-chick business, as well as the fireless brooder, has come to stay, though if it pays one man to hatch day-old chicks for sale it will surely pay the farmer to artificially incubate on a small scale for himself. The problem, after all, is the rearing of chickens rather than the hatching of them, and if a man can rear successfully he should certainly be able to manage the more simple process. Artificial incubation and brooding have passed the experimental stage, and with a little care and attention no difficulty is now experienced in providing sufficient pullets each year to ensure a good supply of eggs in the dear season. With the up-to-date incubators and brooders now available persons with an ordinary amount of intelligence can soon master their working. Naturally, where possible, the beginner is advised to get a few lessons from a practical operator and thus gain the benefit of his experience at the outset.

Because a person is capable of working an incubator or brooder successfully it does not necessarily follow that the best results will be obtained. The first essential in securing good hatches of chickens that are easy to rear is to have strong, vigorous breeding stock that are not overfat, and which have not been and are not being overforced for egg-production. Usually it is a weak policy to buy a cheaply built incubator, or one of those which find their way to an auction-mart. These are mostly amateur-made or out-of-date machines, which in many cases have been discarded by the person of experience. Obviously, if he is installing more up-to-date and better machines the novice should do likewise.

Farm poultry-keeping is capable of great expansion in New Zealand, especially among those who are working the smaller holdings. The first thing necessary to make farm poultry pay is to keep the correct type of bird, and only such numbers as can be effectively handled and properly fed and looked after. They should not be left to hunt for their living and remain till they die of old age. Many farmers still declare that there is no money in poultry, and that the average farm hen dies in debt to her owner. This is because they have not given the noted egg-laying strains a trial under modern methods of management. It is on the farm that eggs should and can be produced at the cheapest cost, but the maximum returns will never be secured unless the poultry are given as much care and attention as other animals on the farm. Like the heavy-milking cow, the modern high-type laying-bird will not maintain its great artificially stimulated yield unless well fed, sheltered from adverse weather, and treated in a kindly manner. I do not contend that it will pay to take up poultry on a large scale on the average farm except under special conditions—for instance, where there is a daughter or a son who takes a keen interest in them.

There are few farmers in the Dominion who do not keep poultry to a greater or lesser degree. These notes are not written specially with the object of inducing farmers to increase the number of their fowls, but rather to impress upon them the advantages of keeping a better class of poultry and managing them on sounder lines in order that they may furnish increased returns. It is safe to say that on the majority of farms if only half the number of good young birds were kept, and these were properly fed and managed, they would furnish a better income than is obtained at present. Farmers and others who are really anxious to make the most profit from their poultry are advised to obtain a copy of the Department's Bulletin No. 66, "Utility-poultry Keeping," in which useful information is contained on

practically all branches of the industry, and to which these *Journal* seasonal notes are supplementary. This bulletin may be obtained from the Publisher, Department of Agriculture, Wellington, at a cost of 1s.

HATCHING WITH HENS.

Those who are hatching with hens should take care to have ample provision for cosy coops and runs for the chicks. The coops should be placed on dry ground, and made in such a way that the mother and her brood will be protected from rain and cold winds. It is also essential that they be made cat and rat proof; neglect of this provision means heavy losses of chickens each season. In making the nest take a shallow box about 6 in. deep and 15 in. square, remove the bottom, and place on the ground. Half fill it with moist earth, and shape the nest with the hands so that the eggs will have a tendency to remain in the centre; in other words, make it saucer-shaped, care being taken that it is flat on the bottom to enable the hen to turn the eggs, which she does several times a day. Neglect in this direction is a common cause of eggs being broken in the nest. The nest should be lined with a thin layer of hay, fine straw, &c.

Place the hen on a few china eggs until satisfied that she can be entrusted with the eggs intended for incubation. Before the hen is placed on the nest give her a good dusting with carbolic or other insect-powder in order to destroy any vermin that may be on her. More trouble and loss are occasioned by vermin in the rearing of chickens under hens than by anything else. Do not meddle too much with the hen when she is hatching. She can attend better to her natural business than you can, but as she is not carrying out her work in a state of nature her requirements must be considered. The application of moisture to the eggs is a case in point. Sometimes the air-cell dries down to such an extent that the thin membrane inside the shell becomes so tough that the chicken is unable to pierce it and consequently dies of suffocation. Here nature may be assisted by providing moisture. The best means is to take the hen off, lift up the nesting-material, and give the earth underneath a good moistening. This is preferable to sprinkling moisture on the eggs or dipping in water. The object should be not to wet the eggs, but by applying the submoisture to encourage, by means of a hen's body, a humidity in the air surrounding the eggs.

When the chicks are moved to the coop, which should be constructed in such a way that plenty of fresh air and light are provided, both the hen and the chickens should be enclosed for the first two or three days. Then provision should be made whereby the chickens can run in and out in order to afford them exercise. It is always a mistake to allow a hen with a young brood a free range. When the sitting-hen is confined in a box she should be let off once a day to feed, drink, and dust herself. It is, however, much better for her if she is placed in a coop with a roomy run attached; she can then have before her at all times everything she requires, thereby minimizing the time required for attending to her. Hard grains, clean water, and grit are all the food that a sitting-hen needs.

—*F. C. Brown, Chief Poultry Instructor.*

THE APIARY.

FOUL-BROOD.

It is evident from opinions expressed by many beekeepers in reference to foul-brood that the highly infectious nature of the disease is not fully understood. In a bulletin on the subject, written by Dr. C. F. White, specialist in insect diseases, and issued by the United States Department of Agriculture, is given a brief summary of the facts known about American foul-brood (the form present in this country), together with a few conclusions, which may be usefully quoted here, as follows:—

"American foul-brood is an infectious disease of the brood of bees caused by *Bacillus larvæ*.

"All larvæ—worker, drone, and queen—are susceptible to the infection; adult bees are not.

"The brood of bees can be infected through feeding the spores of the bacillus to a colony.

"The spores contained in a single scale are more than enough to produce considerable disease in the colony.

"The portal of entry of the infecting agent is somewhere along the alimentary tract of the larvæ, most likely the stomach (mid-intestine).

"The incubation period is approximately seven days.

"The brood is susceptible to infection at all seasons of the year.

"More brood dies of the disease during the second half of the brood-rearing season than during the first half.

"The course of the disease in the colony is not affected greatly, if at all, by the quality of food used by the bees, or by the quantity present.

"The spores of American foul-brood remain alive and virulent for years in the dry remains (scales) of larvæ and pupæ dead of the disease, and in cultures that have become and remain dry.

"The spores are very resistant to most destructive agencies. A variation in resistance is noted both as to the individual spores of a sample and as to the spores contained in different samples.

"Many of the spores are killed within one minute at 100° C., and all of them from some samples are killed in less than five minutes. In some instances 96° C., maintained for ten minutes, will destroy all of the spores, while 98° C. will often do it. The most resistant of the spores studied when suspended in water have not withstood 100° C. for eleven minutes.

"The spores withstand more heating when they are suspended in honey or honey diluted with water than when suspended in water.

"The spores suspended in honey or diluted honey can be destroyed by 100° C., but it may require half an hour or more to do so.

"American foul-brood spores, when dry, were destroyed by the direct rays of the sun in from twenty-eight to forty-one hours.

"The spores, when suspended in honey and exposed to the direct rays of the sun, were destroyed in from four to six weeks.

"The spores, when suspended in honey and shielded from direct sunlight, remained alive and virulent for more than a year. It is very likely that they are capable of remaining so for a very much longer period.

"The spores resisted the destructive effects of fermentation for more than seven weeks at incubator and outdoor temperatures respectively, and probably are able to withstand these agencies for a very much longer period.

"The spores resist carbolic acid at room-temperature in strengths ordinarily used as a disinfectant for periods of months; 1–1,000 mercuric chloride, for days; 10-per-cent. formalin, for hours.

"American foul-brood infection is transmitted primarily through the food of bees; possibly at times to some extent through their water-supply. Robbing from the diseased colonies of the apiary or from neighbouring apiaries is the most likely mode by which the disease is transmitted in nature.

"The placing of brood-combs containing diseased brood with healthy colonies will result in the transmission of the disease.

"Flowers should not be considered as a likely medium through which infection may take place.

"Whether the disease is ever transmitted by queens or drones has not been determined. That they have been overestimated at times as possible sources of infection seems likely.

"It is quite probable that in many cases hives which have housed colonies infected with American foul-brood will not transmit the disease to healthy colonies transferred to them. Results from the present studies confirm the observation made by beekeepers that danger from this source may be removed by properly flaming such hives inside.

"The clothing of those about an apiary, and the hands of the apiarist, are not fruitful sources for the transmission of the disease.

"Tools and bee-supplies generally about an infected apiary will not transmit the infection in the absence of robbing from those sources.

"American foul-brood usually can be diagnosed from the symptoms alone. A definite diagnosis can always be made from suitable samples by bacteriological methods.

"The prognosis in the disease in the absence of treatment is decidedly grave, but with proper treatment it is favourable.

"From the technical viewpoint many of the problems considered in these studies have been solved only partially; from the practical point of view, however,

the results are sufficient to make a logical, efficient, and economic treatment of American foul-brood possible."

Dealing with the spore stage of the disease, Dr. White says: "Scales of American foul-brood obtained in 1907 from colonies in which the disease had been produced through experimental inoculation were stored in the Laboratory. Each succeeding year for nine years tests were made relative to the viability of the spores in this material. In 1916 they were still alive and as resistant to heat and as virulent as at any previous time. It is most likely that they would have withstood the drying at room-temperature for a very much longer period than nine years."

—*H. W. Gilling, Apiary Instructor.*

THE GARDEN.

VEGETABLE-CULTURE.

SEED-SOWING as advised last month is appropriate for the coming month also; arrears should be brought up as may be convenient.

Turnips can be sown generally. Extra Early Milan is probably the quickest variety to sow, but only a small breadth of this should be sown, to be followed by Snowball, which is a better variety, and takes very little longer to come into use. Where the seeds are sown by hand the drills can be conveniently made with the end of a rake, holding it flat so as to make a broad and shallow drill. The seeds should be sown rather thinly, covering the full breadth of the drill. Broad rows result, which require very little thinning if roots are pulled as they become large enough for use; a large crop is obtained from comparatively little space.

Early Horn carrots should be sown for the first crop. Sow as described for turnips, and a heavy crop can be taken. The roots of the Horn varieties are usable when very young and small. Thinning the rows as roots are wanted for use allows those left space to increase in size, and the crop will carry on till the larger varieties, sown later on, come into use.

Where red beet is required for use during the summer months a turnip-rooted variety should be sown. These varieties come in quickly, but they are not so good for winter use as the long varieties, which should not be sown till November.

Turnip-rooted parsnips are useful in summer. They may be sown now if they are wanted, but long varieties alone are suitable for winter use, and should not be sown till November, or possibly October in colder districts.

Celery for first crops should be sown in boxes under glass. Use a compost of clean loam with a good proportion of old manure and coarse sand to give it body. Sow rather thinly, and prick off the seedlings as soon as they can be handled; crowded seedlings are difficult to deal with because they are very weak. Henderson's White Plume is the best variety for early crops.

Rhubarb of the summer varieties should be planted at once in rich soil. Plant in rows 3 ft. apart, with the crowns 2 ft. 6 in. apart in the rows. The crowns should be barely covered with soil. Any one intending to establish beds from seeds should sow at once. The seeds may be sown in rows just far enough apart to allow for hoeing and weeding. Drop the seeds 3 in. or 4 in. apart in the rows. When the seedlings are large enough they can be lifted and planted afresh, allowing space for further development. It should be understood that seedlings vary very much in character, and selection later on is necessary for the establishment of a good-paying strain.

Winter rhubarb should be in full use. If it has not lately been manured an application should be made now; failing stable or farmyard manure a good dressing of fowl-manure will answer. In either case a dressing of nitrate of soda, 2 oz. per square yard, should also be given.

Tomato-seed for open-air crops should be sown; it has already been sown in the warmer districts; but in other places the latter half of August is early enough. All the evidence is against planting out too early; among other things, sleepy disease from the pathogen usually experienced in this country is attributable in the main to planting too early. No artificial fertilizer of any kind should be mixed with either the soil for sowing seeds or that used for pricking off the seedlings.

The soil should be prepared for new plantations of asparagus, but planting should be deferred till the young plants begin to move. In most cases this is early in September.

SMALL-FRUITS.

Strawberries.—The time for planting varies in accordance with climate and conditions of soil; also it is largely ruled by the purpose for which they are grown. In commercial plantations in the North planting is done in autumn, being usually completed by the end of April, and the plants are renewed every year. In some places in the South Island planting is done in spring, and a full crop is not expected till the following year. In both cases the magnitude of the operation forbids slow ways of planting, which accounts for the small crop obtained the first year in some places in the South. In the northern plantations the plants have time to get a good root-hold and to improve the crowns before flowering begins. The case of the small grower is different, and methods involving a proportionately greater amount of labour are possible. Autumn planting is not practicable in a climate where the soil cannot be cultivated in the winter, because it would in most cases become covered with weeds, which mostly would have to be pulled out by hand. Moreover, in such circumstances the plants would do very little good during winter, and the soil would be battered down by rain and become unwholesome. It is best, therefore, to leave planting till spring. The plants should, however, be secured in autumn—about the month of March—and be planted in temporary beds in well-drained soil, spacing each plant 3 in. or 4 in. apart. In this position roots are freely made, and by spring there will be fine plants, which can be lifted with a fork, with roots intact, and planted early in August with scarcely any check. Such plants will produce a good crop the first year, being in practically the same condition as the plants set out in autumn in the northern plantations. Where leaf-spot is troublesome spray the plants with 4–4–40 bordeaux.

Loganberries.—Planting should be completed as soon as possible. Cut the young plants down to one or two good buds. For commercial purposes the plants should be set about 12 ft. apart in rows 8 ft. apart, and a trellis erected to support the rods. The erection of the trellis may be left till the following year, the growth made in the meantime being supported by stakes. In a domestic garden the rods may, if desired, be trained to a fence or the wall of a building. In this case the usual plan of renewing the rods every year can be departed from, keeping them to fruit two years instead of one. The side shoots that have borne fruit should all be cut back to two buds at their base. Before growth begins loganberries (also raspberries and gooseberries) should be sprayed with 6–4–40 bordeaux.

Cape Gooseberries.—Plants that are to stand another year should be cut down to about 6 in. from the ground. In places where frost occurs the branches will be cut or killed, and in these cases the tops should be left till frosts are over. In the meantime new shoots will appear at the base, which the branches, though they may be dead, will shelter. Seeds to provide new plants should be sown at once if this is not already done. Personally, I like to sow in autumn.

—*W. H. Taylor, Horticulturist.*

ENTRY OF STUD STOCK INTO THE UNITED STATES.

INFORMATION has been received that Astoria, at the mouth of the Columbia River, Oregon, has been declared an additional port of entry for foreign live-stock. Importers, however, will have to provide suitable quarantine accommodation for any stock landed there. It is considered that this new facility will be of decided advantage to the import business in sheep from New Zealand. Breeders in the Oregon and Washington sheep-raising districts have long objected to their purchases being landed at San Francisco or Vancouver, owing to the knocking-about the animals are liable to on the subsequent railway journey. It is stated that a valuable Romney ram from Southland had two legs broken on the railway journey between San Francisco and southern Oregon.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

DISTINGUISHING COWS UNDER TEST.

C. F., Pakaraka :—

Would you be so good as to tell me the best plan for branding a dairy herd of seventy cows? The object is for keeping a weight and test record, names being unsatisfactory. I thought numbering on rump would be the best thing. Is there not a paint brand that can be stencilled on and yet become a permanency?

The Live-stock Division :—

The subject of distinguishing cows under test has been given considerable thought, and it is still held that naming the cow is the most convenient method, and is the one generally in use. It has to be remembered that branding a number on the animal with the hot iron or liquid branding-fluid is not permissible under the Stock Act, which requires registration of all brands. Painting the number on cannot be said to be of any value, as it is usually obliterated in a short time.

SUMMER FORAGE CROPS FOR EWES AND LAMBS.

"INQUIRER," Dromore, Canterbury :—

Could you suggest any crop which could be put in here during August or September to provide feed for ewes and lambs about November and December? We have found that neither ewes nor lambs do well if left on autumn-sown oats during those months, and if the weather is dry the grass is then going off. Rape does not do well here if sown before November, and lucerne appears to be hard to establish on this class of land.

The Fields Division :—

Owing to local conditions your scope is somewhat limited, but the following crops may be suggested for green feed from November to January: (1.) Spring-sown oats (2 to 3 bushels Algerians) sown in September, with 1 cwt. super-phosphate per acre. (2.) Cape barley (2 to 3 bushels) sown at end of September, using 1 cwt. super per acre. (3.) Black Skinless barley (2 to 3 bushels) sown at end of September, with 1 cwt. super per acre. (4.) Western Wolths, 25 lb., and cow-grass, 4 lb., sown at end of September, with 1 cwt. super per acre.

LAMBS WITH SORES ROUND MOUTH.

W. G. BONNER, Rahotu :—

I should be pleased if you would inform me the cause of, and remedy for, a number of my lambs breaking out in sores around the mouth. In one or two cases the upper lip is quite swollen, and the sore is very raw; in others the soreness is along both the upper and lower lips; the inside of the mouth is not affected. The paddock they have been grazing on (grass, old pasture containing rushes and cutty-grass) is very low-lying, and owing to the continual rain is very wet. I have removed them to a hilly paddock and isolated the ones affected.

The Live-stock Division :—

The primary cause of this condition is excessively wet pasture. The tissues are softened and then injured by the grasses, thus affording an entry for organisms. As carried out by you in this case, the lambs should be removed to dry pasture and the affected ones isolated for treatment. Hand feeding should

be resorted to in the meanwhile. The parts should be bathed daily with a warm, weak solution of either Jeyes fluid or lysol, and then a little of the following ointment applied: Carbolic acid, 1 dram; eucalyptus-oil, 1 dram; zinc oxide, 3 drams; and vaseline, up to 4 ounces.

POLLINATION OF FRUIT-TREES.

R. W. WRIGHTSON, Ohingaiti :—

I have a Moorpark apricot-tree, now five years old, which has bloomed for three seasons, but has had no fruit. The nearest apricot-trees are three miles away. Is it necessary for me to have another tree to obtain fruit?

The Horticulture Division :—

It is only in recent years that it has been realized that some varieties of fruit-trees are sterile to their own pollen. Only by very careful observations carried out over several years can a determination be come to as to whether a variety is or is not sterile in this way. Apricot varieties have not yet had this attention, therefore we have no certain knowledge with regard to this fruit. It is, however, an established fact that even varieties of apples and pears that are perfectly self-fertile are made more fruitful by interpollination with another variety, and it is reasonable to suppose the same applies to other fruits. For this reason we never advise the planting of one tree of any kind of fruit. With regard to apricots, it should be understood that they succeed in comparatively few places, also that they blossom very early, and frost may destroy the blossoms. If you decide to plant another tree it is necessary to select a variety that comes into blossom at the same time as the Moorpark which you have. Any of the following will answer: J. L. Budd, Harris, St. Ambroise, and Campbellfield Seedling.

AUTUMN-SOWN TEMPORARY PASTURES.

"PASTURE," Christchurch :—

Will you kindly state if it is a good practice when laying down a temporary pasture to sow the grass and clover with an autumn-sown crop of wheat? The grass-mixture, I understand, would be sown at the time of spring rolling. Also, if I plough in 4 in. wheat-stubble as soon as the crop is in stack, and give the land a good working with the grubber, would I be able to sow rye-grass in March with any chance of a good crop?

The Fields Division :—

The practice of sowing down temporary pasture in the spring on land which was seeded with wheat in the autumn is a fairly common one. A number of instances have come under notice this season, the resulting pasture in most cases being very satisfactory. The grower is somewhat at the mercy of weather conditions, for if a very dry harvest is experienced the young grass and clover plants are likely to be burnt out prior to or on sudden exposure to the sun. Though it is not the ideal method to sow perennial rye-grass on a hastily prepared seed-bed after wheat, there is no reason why the resultant crop should not be good if sown not later than March. Italian rye-grass can be sown under these conditions with a greater certainty of success.

CROSSING OF DAIRY CATTLE.

G. J. H., Owhango, King-country :—

I am dairying on a bush farm. The majority of my cows are grade Jerseys, and in calf to a pedigree Jersey bull. Taking conditions here at present, I seem to be as far into the Jersey as is advisable until I get more ground stumped and ploughed to provide winter feed. Two cows in the herd are Friesian-Jersey cross, and have tested and milked well through the season. Could you advise me if I would be doing a wise thing by using a Friesian bull on the Jersey cows? The climate here seems to suit the cross.

The Live-stock Division :—

We are of opinion that the use of a Friesian bull on Jersey cows is not to be recommended, principally because of the danger of the unusually large size of the head in the Friesian calf giving rise to difficulties at calving-time, more especially in small Jersey cows. However, a Jersey bull can be used with Friesian cows. With your conditions probably a better cross would be obtained by using an Ayrshire bull on your Jersey cows.

HORSE INFESTED WITH LICE.

"DIGGER," Lowcliffe, Hinds :—

I have a draught gelding very badly infested with lice: will you kindly advise treatment?

The Live-stock Division :—

The application of any coal-tar sheep-dip of good quality is a safe cure. It should be used in the same strength as for dipping sheep. The solution must be well rubbed in all over the animal's body with a stiff dandy-brush, and, for preference, a warm dry day should be chosen. The animal should be dressed again nine days afterwards, as the solution will not kill the "nits," or eggs, which hatch in seven or eight days. Sometimes a third dressing is required. All covers, &c., which have been in contact with the affected animal should be soaked in the solution for three or four hours and dried in the sun.

CONTROL OF POTATO-EELWORM.

W. H., Lyttelton :—

Would you kindly inform me if potatoes slightly infected with eelworm could be safely used for seed, and if the ground from which they were taken would affect a crop planted on it next season? Are there any effective preventives?

The Fields Division :—

Treatment in cases of field infection with potato-eelworm (*Heterodera radicicola*) consists in careful rotation of crops. No crop attacked by the worm should be sown on the same ground for a number of years. Plants attacked are tomatoes, cucumbers, potatoes, cabbage, turnips, lucerne, and certain fruit-trees, especially the peach. The refuse from a diseased crop will carry eggs for an indefinite period, and should be burnt. Infested tubers must not be used for seed purposes.

New Rabbit District.—The Eastern Pohangina Rabbit District, Wellington Province, has been constituted for the purposes of Part III of the Rabbit Nuisance Act.

"*Diseases of Farm Animals.*"—Purchasers of this recently issued book are requested by the publishers, Messrs. Whitcombe and Tombs, Lambton Quay, Wellington, to communicate with them, and obtain an extra page containing an important correction by the author. This will be forwarded free of cost on receipt of name and address.

British Market for Peas and Beans.—The following information was cabled by the High Commissioner, London, on 7th July: *Peas*—Maple quietly steady with occasional small business for June and July shipments; July–August shipments sold 80s. per quarter; Tasmanian afloat offered at 95s.; spot trade slow; New Zealand offered at 95s.; Tasmanian 107s. 6d. ex store. Blue firmer, and influenced by speculative buying of Japanese; New Zealand to arrive sold at £18 10s. per ton c.i.f.; poorer quality colonial meets with poor demand. English crop reported backward. *Beans*—All requirements have been met by Home-grown. English horse in poor demand, selling at 8s. 9d. to 9s. 6d. per hundredweight. Pigeon in better request at 15s. to 18s.

WEATHER RECORDS: JUNE, 1923.

Dominion Meteorological Office.

GENERAL SUMMARY.

METEOROLOGICAL reports for the month of June show a remarkable number of days with rain in the North; for instance, at Auckland and Hamilton there was only one day on which a measurable quantity of rainfall was not recorded. This, together with the lack of sunshine, accounted for very little drying on the land and the roads, and a wet and wintry season. Snow came low down on the Southern hills, and hailstorms and rain occurred frequently at night. Cold and fair conditions were prevalent in the east-coast districts, with an absence of high winds—as often occurs in the winter months, of which June is counted the first.

The total rainfalls for the month were above the average in the north and west-coast districts of the North Island, and were also in excess in Southland; but in most other parts, especially of the east-coast districts, the totals were below the means for the same month in previous years. Auckland City had a total fall 86 per cent. above the average; but, as if to compensate for its previous excess, Blenheim was 76 per cent. below the average.

Auckland experienced 86 hours of bright sunshine; New Plymouth, 92 hours; Weraroa (Levin), 95 hours; Wellington, 124 hours; Hokitika, 118 hours; and Nelson, 156 hours.

—*D. C. Bates, Director.*

RAINFALL FOR JUNE, 1923, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average June Rainfall.
North Island.				
	Inches.		Inches.	Inches.
Kaitaia	8·66	22	2·22	5·53
Russell	5·58	18	1·52	6·28
Auckland	8·96	29	1·06	4·82
Hamilton	6·46	29	1·18	5·07
Kawhia	9·06	26	1·02	5·46
New Plymouth	8·98	26	1·43	6·21
Inglewood	13·13	25	2·53	10·54
Whangamomona	9·46	27	1·28	7·92
Tairua, Thames	8·28	24	0·96	6·95
Tauranga	4·48	23	0·78	5·09
Maraehako Station, Opotiki ..	6·04	19	1·18	5·68
Gisborne	3·80	10	1·82	5·21
Taupo	4·20	24	1·20	4·35
Maraekakaho Station, Hastings ..	2·94	13	1·36	3·44
Taihape	5·42	26	0·83	3·79
Masterton	3·03	14	1·26	3·41
Patea	4·37	20	0·84	4·40
Wanganui	3·91	17	0·63	3·29
Foxton	3·17	13	0·60	2·94
Wellington	3·40	12	0·84	4·92
South Island.				
Westport	8·22	23	1·00	7·53
Greymouth	7·88	17	1·02	8·99
Hokitika	10·76	19	1·20	9·83
Arthur's Pass	6·02	9	1·65	9·77
Okuru, Westland	8·48	13	1·88	10·76
Collingwood	5·47	19	1·35	11·33

RAINFALL FOR JUNE, 1923—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average June Rainfall.
South Island—continued.				
	Inches.		Inches.	Inches.
Nelson	1·12	13	0·26	3·77
Spring Creek, Blenheim ..	0·77	8	0·30	3·23
Tophouse	2·92	14	0·57	4·99
Hanmer Springs	1·36	4	0·68	2·83
Waiau (Highfield)	1·68	6	0·60	2·33
Gore Bay	1·59	7	0·76	2·30
Christchurch	2·22	14	0·76	2·64
Timaru	0·64	10	0·18	1·84
Lambrook Station, Fairlie ..	0·78	5	0·44	2·06
Benmore Station, Omarama ..	1·56	8	0·54	2·06
Oamaru	0·45	4	0·16	2·11
Queenstown	4·57	10	1·18	2·41
Clyde	1·58	10	0·46	0·98
Dunedin	4·06	16	1·04	3·12
Gore	7·00	19	1·90	2·76
Invercargill	6·32	23	1·01	3·60

IMPORTATION OF FERTILIZERS, JUNE QUARTER.

FOLLOWING were the importations of fertilizers into New Zealand for the quarter ended 30th June, 1923: *Sulphate of Ammonia:* Australia, 210 tons. *Gypsum:* Australia, 822 tons. *Nitrate of Soda:* United Kingdom, 30 tons; Chile, 50 tons; Belgium, 118 tons. *Basic Slag and Thomas Phosphate:* United Kingdom, 6,416 tons; Luxemburg, 600 tons; Belgium, 15,432 tons; United States, 1,000 tons. *Bonedust:* Australia, 1,350 tons. *Chardust:* Australia, 201 tons. *Guano:* United Kingdom, 19 tons. *Rock Phosphate:* Ocean Island, 750 tons; Nauru Island, 12,250 tons. *Superphosphate:* Belgium, 250 tons. *Kainit:* United Kingdom, 70 tons; France, 797 tons; Germany, 1,365 tons. *Sulphate of Potash:* United Kingdom, 20 tons; France, 55 tons; Germany, 415 tons. *Potash, other:* Germany, 150 tons. *Sulphate of Iron:* United Kingdom, 11 tons. *Fertilizers, other:* United Kingdom, 1 ton.

STOCK SLAUGHTERED, 1922–23.

THE following are the numbers of stock slaughtered at abattoirs, meat-export works, bacon-factories, and ordinary registered slaughterhouses throughout the Dominion during the year ended 31st March, 1923:—

Stock.	Abattoirs.	Meat-export Works.	Bacon-factories.	Ordinary Slaughterhouses.	Totals.
Cattle ..	125,483	155,881	..	67,035	348,399
Calves ..	24,620	7,504	..	1,843	33,967
Sheep ..	690,297	1,927,317	..	295,964	2,913,578
Lambs ..	109,256	4,410,895	..	25,642	4,545,793
Swine ..	112,761	86,351	22,661	22,089	243,862

Noxious Weeds.—Ox-eye daisy has been declared as a noxious weed in the County of Otorohanga.